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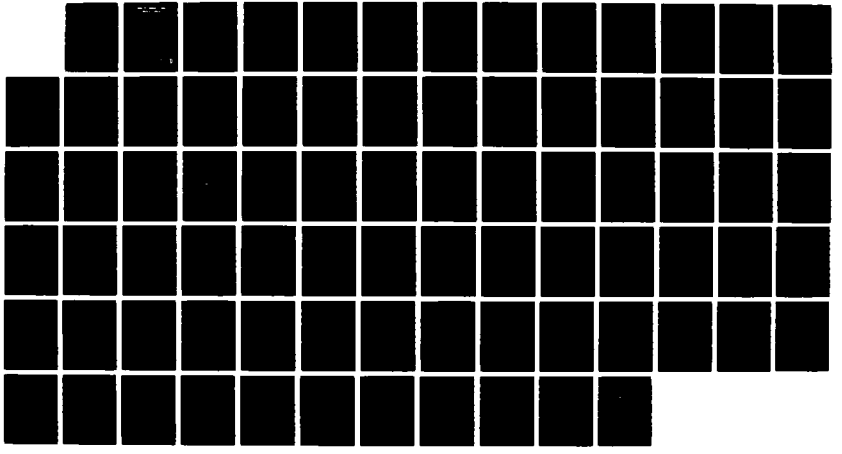

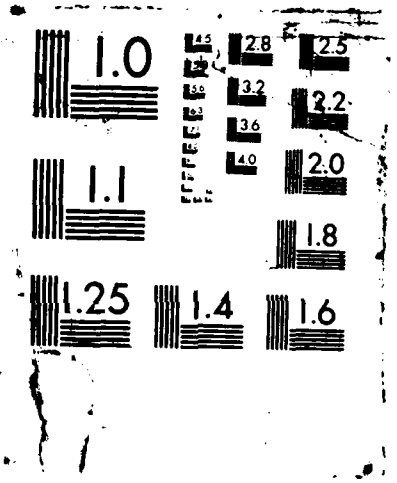
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE EFFECT OF THE GOLDWATER-NICHOLS DEPARTMENT OF DEFENSE REORGANIZATION ACT ON SURFACE WARFARE OFFICER CAREER PATHS

by

Thomas F. Steward

December 1987

Thesis Advisor Paul R. Milch

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The Effect of the Goldwater-Nichols Department of Defense Reorganization Act on Surface Warfare Officer Career Paths

by

Thomas F. Steward
Lieutenant Commander, United States Navy
B.S., Southern Methodist University, 1972

Submitted in partial fulfillment of the
requirements for the degree of

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December 1987

Author: Thomas F. Steward
Thomas F. Steward

Approved by: Paul R. Milch
Paul R. Milch, Thesis Advisor

Thomas E. Halwachs, Second Reader

David R. Whipple, Chairman,
Department of Administrative Sciences

James M. Fremgen,
Acting Dean of Information and Policy Sciences

ABSTRACT

This thesis reviews the joint officer management policies mandated by the Goldwater-Nichols Department of Defense Reorganization Act and analyzes their effect on Surface Warfare Officer (SWO) career paths. The focus of this thesis is the balance between joint education and experience on the one hand, and service specific education and experience on the other hand. The analysis is conducted using the SWOPATH model of SWO career paths developed in an earlier Naval Postgraduate School thesis. The results show grade creep in the Commander command billets of SWO career paths resulting from a shift in emphasis toward joint experience.

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I. INTRODUCTION

A. PROBLEM

On October 1, 1986 the Goldwater-Nichols Department of Defense (DOD) Reorganization Act became law. Among the Law's stated purposes are:

1. to improve the military advice provided to the President, the National Security Council, and the Secretary of Defense;
2. to improve joint officer management policies; and
3. otherwise to enhance the effectiveness of military operations and improve the management and administration of the Department of Defense. [Ref. 1: SEC. 3.]

To accomplish the improvement of joint officer management, the Law creates a new specialty for officers of all services, the joint specialty. The goal of the Law's joint officer management policies is to ensure that competitive officers, who are current in their warfare specialties, are introduced into joint assignments.

The Law sets forth specific policies for the management, promotion, education and tour length of these specialists and in doing so, delves into areas which have been the concern of the individual services and threatens to disrupt the traditional progression of career enhancing assignments established by the services. The Law, in effect, mandates a new category of career enhancing assignments, namely, joint assignments. A career enhancing assignment is one which the service determines to be challenging and which, if completed successfully, keeps an officer competitive for promotion and positions of increased responsibility. Traditionally, career enhancing assignments are the result of service policy and do not carry the force of law.

Consequently, when viewed in the framework of existing career progressions, the joint officer management policies established by the Goldwater-Nichols Act threaten to defeat the very purpose they were intended to achieve by creating a subspecialty path that removes current and competitive officers from their warfare specialty for extended periods of time.

The Goldwater-Nichols Act has generated renewed scrutiny of joint duty assignments and the Intermediate and Senior-level Professional Military Education (PME) leading to those assignments. The Chairman of The Joint Chiefs of Staff convened the Senior Military Schools Review Board to study the 'jointness' of PME.

In its report, the Senior Military Schools Review Board stated:

> The JSO (Joint Service Officer) is not an elite officer and should not be divorced from the mainstream of the Services. [Ref. 2: pg 12]

Further, the board stated that in visits to the senior and intermediate Service schools:

> The Commandants and faculties of these colleges cautioned against trying to produce joint officers who do not understand the capabilities and limitations of their own Service. They persuasively described our nation's need for officers who perform well in the joint area because of their Service-specific knowledge and skills, not despite their expertise and experience. [Ref. 2: pg 1]

In interviews with the board:

> Key military commanders emphasized the need to integrate the joint specialists into the entire defense establishment, not to segregate them into a separate group with different experiences and education. [Ref. 2: pg 1-2]

Given that the joint officer management policies are law, and that the traditional career enhancing assignments are service policy, then the task for the services is to accommodate the law, and its intent, without weakening an officer's experience in service related assignments.

In further discussions of this issue I will focus on U. S. Navy Unrestricted Line (URL) officers and more specifically the Surface Warfare Officer community of URL officers.

B. BACKGROUND

An Unrestricted Line Officer is a naval officer who is eligible to command ships or aircraft.

1. The Surface Warfare Officer Career Path

The SWO community is defined as follows:

> The Surface Warfare Community is composed of officers who are qualified in the surface warfare specialty, who man the surface ships of the Navy and whose goal is to command those ships. The Surface Warfare Officer (SWO) must develop experience and in-depth knowledge in a specific line of discipline (operations, combat systems or engineering) and learn the fundamentals of engineering, weapons systems, and operational tactics. [Ref. 3: pg. 30]

Key to understanding the SWO career path is the ultimate goal of commanding ships. Whether as Commanding Officer of an individual ship, or as Squadron, Group or Fleet Commander, it is the command of ships which drives the determination of the SWO career path. This emphasis on command at sea places certain constraints on a SWO's career path in the form of required professional training and operational sea tours. Specifically these tours are:

1. SWOS Division Officer course
2. Division Officer tour
3. SWOS Department Head course
4. Two Department Head tours
5. Perspective Executive Officer (PXO) course
6. Executive Officer (XO) tour
7. Perspective Commanding Officer (PCO) course
8. Commanding Officer (CO) tour
9. Major Command tour

In recent guidance to promotion and continuation selection boards, the Secretary of the Navy directed that "renewed emphasis" be given to operational experience in the promotion of Naval Officers [Ref. 4]. This guidance strengthens the primacy of the above progression of tours in the SWO career path.

Although the SWO career path emphasizes operational sea tours, it also places a premium on the development of a subspecialty.

> The subspecialty system recognizes continued operational development ... as the cornerstone of URL career development and, at the same time, to meet total Navy requirements, encourages concentrated development in a subspecialty field. [Ref. 3: pg. 14]

Development of a subspecialty entails graduate education and or repeated tours ashore in a subspecialty area.

Traditional career enhancing shore assignments include the Naval Postgraduate School, a service college, instructor duty, recruiting duty, duty at the service headquarters (OPNAV) or duty on a major staff.

The Surface Warfare Officer career path is, then, the progression of assignments of increasing responsibility which an officer must follow to attain command at sea. The Surface Warfare Officer career path is depicted in Figure 1.1.[1]

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[1]Source: URL Officer Career Planning Guidebook

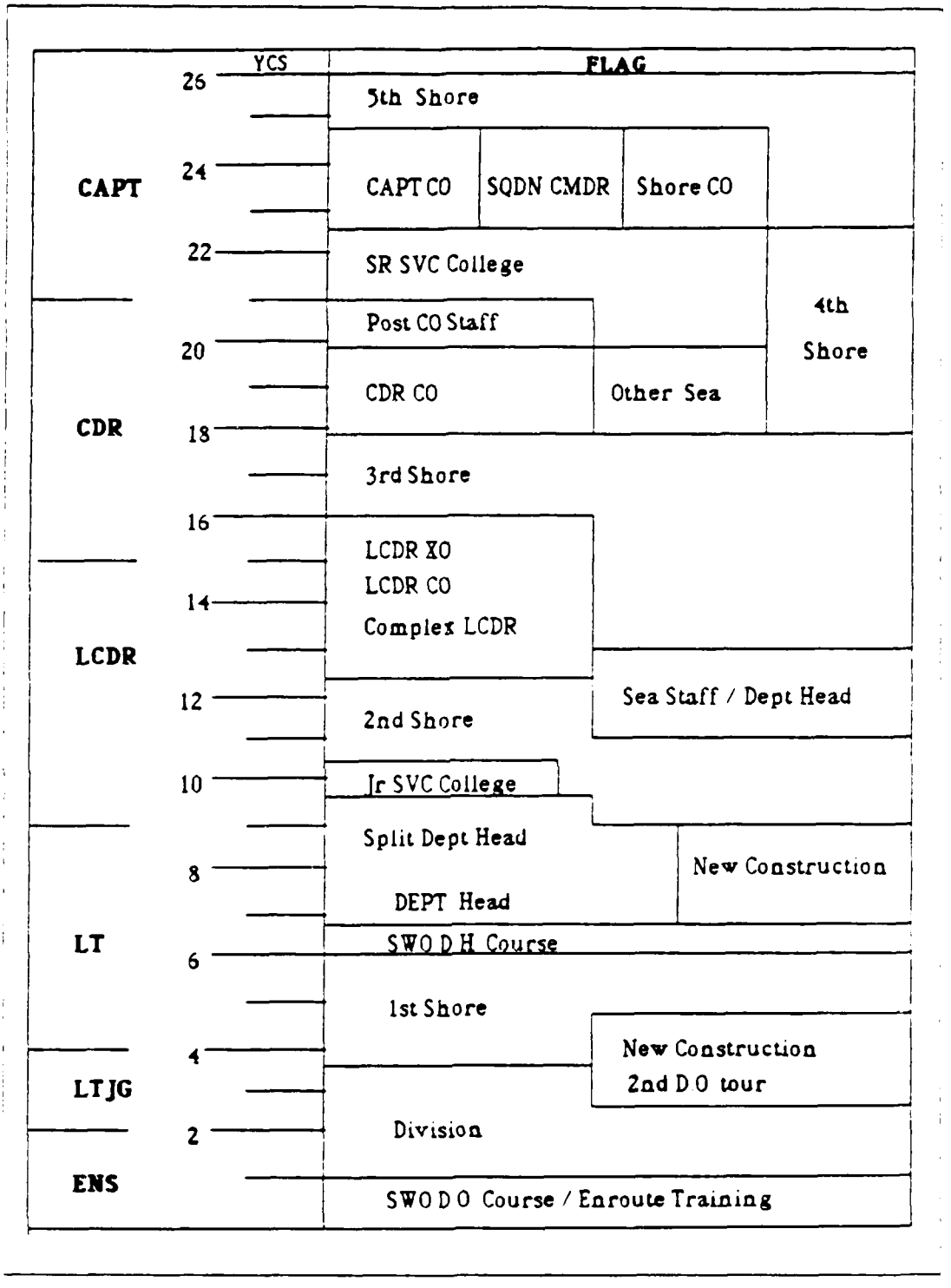

Figure 1 1 SWO Career Path.

2. The Joint Specialty (JSPEC) Officer

The DOD Reorganization Act defines joint matters as:

> relating to the integrated employment of land, sea, and air forces, including matters relating to-
>
> 1. national military strategy
> 2. strategic planning and contingency planing; and
> 3. command and control of combat operations under unified command. [Ref. 1: Title IV, SEC 401]

A JSPEC is therefore and officer who is nominated or designated as having a specialty in planning and command and control in a unified command.

An officer may be nominated by a service Secretary as a JSPEC if he is an officer of paygrade O3 or above and he completes a course of instruction at a joint professional military education (PME) school. Presently, only the colleges of the National Defense University (NDU); the Armed Forces Staff College (AFSC), the National War College (NWC), and the Industrial College of the Armed Forces (ICAF) qualify as joint PME schools. [Ref. 1: Title IV, SEC. 401]

An officer is designated as a JSPEC by the Secretary of Defense if he is nominated as a JSPEC and completes a full tour of duty in a joint assignment [Ref. 1: Title IV, SEC. 401]. JSPEC's are further divided into those officers with and without a Critical Combat Operations Skill (CCOS) [Ref. 1: Title IV, SEC. 401]. Those officers with the SWO designator and who are ordered to tours at sea as Commanding Officer or Executive Officer are said to have a CCOS.

The promotion rate for nominated and designated JSPEC's can be no less than that of officers of the same armed force, grade and competitive category with service headquarters (OPNAV) experience. The promotion rate for any officer serving in a joint assignment can be no less than that of all officers of the same armed force, grade and competitive category. [Ref. 1: Title IV, SEC. 401]

The Law requires that by 1992, any officer selected for promotion to flag or general rank must have served in a joint assignment prior to selection [Ref. 1: Title IV, SEC. 404]. It also directs that:

> Any selection board that will consider officers who are serving in, or have served in, joint duty assignments shall include at least one officer designated by the Chairman of the Joint Chiefs of Staff who is currently serving in a joint duty assignment. [Ref. 1: Title IV, SEC. 402]

The law stipulates that all officers nominated for the joint specialty must serve in a joint assignment immediately following their PME course. It further stipulates that fifty per cent of all graduates of the PME courses, regardless of whether they are nominated for JSPEC, must serve in an immediate follow-on joint assignment. [Ref. 1: Title IV, SEC. 401]

The Law also tasks the Secretary of Defense to ensure that at least half of all joint assignments are filled by officers who have, or have been nominated for, the joint specialty. It further tasks the Secretary to designate at least 1000 joint billets, DOD wide, as critical joint billets and to ensure that critical joint billets are filled by officers who are designated joint specialists. [Ref. 1: Title IV, SEC. 401]

Joint assignment tour lengths are to be not less than 3 1 2 years for flag and general officers and not less than 3 1 2 years for other officers unless the officer has a CCOS, in which case, the tour will be not less than 2 years. [Ref. 1: Title IV, SEC. 401]

C. OBJECTIVES/REASONS FOR THE ANALYSIS

The DOD Reorganization Act causes Navy manpower planners to perform a balancing act with the competing interests in the SWO career path. A balance must be established between joint education and experience, on the one hand, and service-specific education and experience, on the other hand, with each drawing and benefiting from the other.

This analysis will focus on that balance and will attempt to answer the following questions:

1. Can the balance between joint education and experience and SWO education and experience be achieved?
2. What are the short term and long term effects on SWO career paths of satisfying the statutory requirements of the Goldwater-Nichols Act, with or without a balance?
3. What changes to SWO career patterns, if any, are necessary possible to achieve the balance?

The results of this analysis will describe the relationships among the variables of the SWO career path and provide a framework from which to evaluate policy decisions concerning the career path.

II. FRAMEWORK

A. BACKGROUND

The analysis of the effects of the DOD Reorganization Act on the SWO career path is conducted using a Network representation of the SWO career path presented by Howe [Ref. 5] and modeled by Amirault [Ref. 6]. Specifically, Amirault's SWOPATH model is used to evaluate both the short and long term effects of introducing the joint specialty into various alternative SWO career paths.

The SWOPATH model is chosen as the tool for this analysis because it provides a macroscopic or 'big picture' view of the Surface Warfare community. The fact that it was designed for use on a personal computer, also makes it easy for the analyst to answer "what if?" type questions rapidly.

It should be noted that the model is not a detailer's tool because it lacks the specificity necessary for that use. For example, in this application of the SWOPATH model, all types of shore duty tours except Professional Training, Professional Education, Joint Education, and Joint Tour are grouped together into one activity. This is necessitated by the eight activity limit of the model. Increasing the number of activities would require a fairly extensive re-programming effort. Similarly, at any one tour, no distinction is made, within the Professional Education activity, between the Naval Postgraduate School and the various service colleges. This distinction is left for the user to make outside of the model. Finally, the quarterly time interval, imposed by the model, for each iteration of the calculations does not allow the degree of specificity that a detailer would want.

The model is, however, adequate for the study of the general trends of interest to the manpower policy maker. Despite the limitations discussed above, there remains sufficient flexibility in the model to make it a very satisfactory tool for policy analysis. As is the case for this study, a minimum of programming knowledge enables the user to tailor the model to his particular use. Ultimately, no re-programming is necessary if the user is unconcerned with the activity labels on the output of the program. Modifications made to the model for this study are discussed in a subsequent section.

B. THE SWOPATH MODEL

The SWOPATH model is a menu driven, interactive simulation model written in TURBO PASCAL®.[2] It is based on a network of eight activities, represented by rows, and twelve tours, represented by columns. While the order of the activities has no particular significance, the order of tours from left to right represents the passage of time and increased seniority of the officers. A node is a specific activity tour combination and an arc is a path between nodes of one column leading to nodes of the next column to the right. A career path can then be represented by a series of nodes connected by one-way arcs pointing from left to right in the network.

Data stored at each node of the network are:

1. the stocks or total number of officers at that node,
2. the length of the assignment at that node in quarters,
3. a breakdown of the stocks at that node by quarters remaining and
4. the high and low limits for stocks at that node.

Data stored on the arcs are the percentages of officers who are transfered from one node to another along the arcs in one iteration of the calculation routine.

Starting with a set of data for the nodes, arcs, tour lengths, high limits, low limits, and with the clock at time zero, the passage of time is simulated iteratively (one quarter at a time) by calculations which apply the transfer percentages to the node data.

Transfers begin with those officers in their twelfth tour who have one quarter remaining in that tour. These officers, who are captains at the 25 year point of their careers, represent the upper limit of the system modeled and are transfered out of the system. For the rest of the officers in the twelfth tour, the quarters remaining in that tour are reduced by one. This creates a vacancy at the highest number of quarters remaining in the twelfth tour which is filled by transfers from the previous or eleventh tour. The officers transfered from the eleventh tour are those who previously had only one quarter remaining in the eleventh tour. This process is repeated for each successively lower numbered tour. Finally, vacancies created by transfers from the first tour are filled by accessions.

The Separation activity at each tour serves as a holding place for attritions from the Surface Warfare community and provides an accounting of those attritions. The

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[2]Trademark of Borland International, Inc.

"tour length" for each tour of the Separation activity is one quarter and thus attritions leave the system with each iteration of the calculation routine. See Appendix A for a flow chart of the calculation routine.

C. MODIFICATIONS TO THE MODEL

For the purposes of this analysis, several modifications to the model are made. The activities Washington D.C., Shore (CONUS), and Shore (OUTUS) are combined into one activity, labeled Shore. Two new activities, Joint Education and Joint Tour, are added. With the merging of three activities and the creation of two new ones, the total of eight activities is maintained. See Table 1 for updated activity definitions.

TABLE 1

ACTIVITY DEFINITIONS

A. PROFESSIONAL TRAINING: Student billets in either the SWO Department Head or SWO Division Officer courses of instruction of duration longer than 20 weeks.

B. PROFESSIONAL EDUCATION: Student billets at a postgraduate school or a war college of duration longer than 20 weeks.

C. JOINT EDUCATION: Student billet at one of the colleges of the National Defense University of duration longer than 20 weeks.

D. JOINT TOUR: Tour in a designated joint billet.

E. FLEET UNIT: Ship's company sea duty billets.

F. AFLOAT STAFF: Afloat staff sea duty billets.

G. SHORE: Shore duty billets in the Washington D. C. area, continental United States (CONUS) or non-CONUS not meeting the criteria of A thru D above.

H. SEPARATION: Loss of officers from the SWO community for whatever reason.

When Amirault modified the calculations routine in October 1985, the new source code exceeded the limits of the TURBO PASCAL®[3] compiler. In order to compile the new source code, the code that creates the logo at sign-on was changed and the code which creates the sign-off message was deleted.

The modifications to the model's source code can be found in Appendices D through I.

D. SCOPE

The target population of this analysis is pay grades O1 through O6 of the Surface Warfare Officer community. The target population is limited to male SWO's with designators 1110 (regular Navy SWO), 1160 (regular Navy, in training for SWO), 1115 (active duty Reserve SWO) and 1165 (active duty Reserve, in training for SWO). The population is further limited to officers who are not nuclear trained. Women SWO's, TAR (Training and Administration of Reserves) SWO's and nuclear trained SWO's are excluded because their respective career paths are different enough from the above mentioned target population to constitute separate categories and to obscure the true effect of policy changes on the target population.

E. ASSUMPTIONS

The major assumptions made in developing the framework for this analysis are as follows:

1. Accessions and transfers are computed on a quarterly basis. While in reality this may not be the case (computations may be more or less frequent than quarterly), transfer percentages are adjusted to reflect accurate yearly accessions and transfers.
2. Separations are from the Fleet Unit, Afloat Staff and Shore activities only. Selection standards and incurred additional obligated service preclude separation from the Professional Training, Professional Education, Joint Education, and Joint Tour activities in the model.
3. Joint Education includes any of the colleges of the National Defense University but does not include the specific service colleges.
4. Professional Education through tour 6 is understood to be the Naval Postgraduate School. Beyond tour 6 it is understood to be any of the specific service colleges.
5. The PXO and PCO courses are combined with the XO and CO tours because the courses are shorter than one quarter.

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[3]Trademark of Borland International, Inc.

III. METHODOLOGY

A. BACKGROUND

Both Howe [Ref. 5: p. 46] and Mygas [Ref. 7: p. 10] used a representative career path to Major Command as the basis for their analyses. Similarly, the method used here to investigate the effects of the DOD Reorganization Act on SWO career paths is to establish a Mainstream career path leading to Major Command. First a transfer percentage data file (MNSTRM30.ARD) which reflects current but pre-Reorganization Act policies is created.[4] Then, with the stocks at each node set to zero,[5] the model is run to 30 years and the resulting steady state stocks are saved to a file called MNSTRM30.NOD. The two MNSTRM30 files then become the basis for the creation of two alternative career paths.

In the case of each alternative career path, the stocks of officers are made to be at steady state prior to implementation of the Reorganization Act requirements. This is accomplished by:

1. selecting the file containing the steady state stocks for the Mainstream career path (MNSTRM30.NOD);
2. creating the transfer path file for the specific alternative by editing the Mainstream transfer percentages file (MNSTRM30.ARD) and
3. running the model to 30 years.

The transfer percentages and the resulting steady state stocks are then saved and used as the starting point for the analysis of the effects of the Reorganization Act on the alternative career path.

For the Mainstream career path, and each alternative career path created from it, the requirements of the Reorganization Act are implemented by changing tour lengths and transfer percentages to those required by the Act. Accessions are held constant at 325 officers per quarter (1300 per year). No changes are made, other than those dictated by the Reorganization Act requirements, in order to isolate the effects due to the Act.

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[4]This is done by editing the default transfer percentage file provided with the model.

[5]This is done by selecting the NODEZERO.NOD file supplied with the model.

The clock is set to zero and the model run for five years, stopping every two quarters to determine the changes to the stocks at each node. Five years is chosen to examine the effects of the Reorganization Act before the system has a chance to reach steady state again (i.e. short term effects). By looking at the stocks two quarters at a time, the analyst can see any trends developing.

After running the model two quarters at a time to five years, it is then run to 30 years, five years at a time, to determine the long term effects of the Reorganization Act.

The model provides that if any limits are violated during the simulation, a warning is issued and the analyst may:

1. abort the simulation and return to the selection menu;
2. ignore the limits and continue the simulation; or
3. back up one quarter and continue the simulation with alterations.

High and low limits are set at plus and minus 10 percent of the beginning stocks at each node respectively. Violations of these limits provide the analyst with a warning that a significant change is taking place and focus attention on the activities and tours where change is occuring. When the simulation is complete, the steady state stocks are compared with the stocks at the time the warning was issued to determine any trends.

For this analysis, the point at which a violation occurs is noted and the second option is chosen. For the node at which the limit violation occurs, this results in the high limit being set to its maximum value (9999) or the low limit being set to its minimum value (0).

B. DATA

The data necessary to create the transfer percentage files were obtained from conversations with the Surface Warfare Community Manager (OP-130E1), from various policy statements in the Perspective newsletter published by the Naval Military Personnel Command (NMPC-461D) and from the Department of Defense Reorganization Act. The Mainstream transfer percentages and stocks created for use in this analysis can be found in Appendices B and C.

C. ALTERNATIVES

The alternative career paths chosen for investigation in this analysis are as follows:

1. the Mainstream career path,

2. the Early Department Head career path, and
3. the Single Department Head Tour career path.

Each of these alternatives is discussed in detail in the next chapter.

IV. ANALYSIS

A. INTRODUCTION

The arrangement and sequence of the Joint Education and Joint Duty tours in the career paths presented here are such that, with the exception of two Shore tours, only Joint Duty, Fleet Unit, and Afloat Staff tours are significantly affected by the Goldwater-Nichols Act. The following discussion will therefore concentrate on Joint Duty, Fleet Unit, and Afloat Staff tours. Presentation of the three career paths investigated will be in the following format:

1. Introduction of the career path analyzed;
2. Discussion of the advantages and disadvantages of the career path;
3. Discussion of the procedures for implementing the career path and the requirements of the Reorganization Act in the SWOPATH model; and
4. Discussion of the short term and long term trends resulting from the simulation.

B. THE MAINSTREAM CAREER PATH

1. Introduction

The Mainstream career path depicted in Figure 4.1 is actually a collection of the various sequences of assignments by which the majority of Surface Warfare Officers reach Major Command in their twelfth tour. It takes into account the dynamic nature of career paths, but is not intended to represent every possible combination of assignments which can lead to Major Command. It emphasizes the essential operational sea tours and subspecialty development discussed previously and includes the following features:

1. an initial Department Head tour of 18 months followed by a split Department Head tour of 18 months;
2. the split Department Head tour splits officers 80/20 percent between Fleet Unit and Afloat Staff; and
3. 70% of the officers serving a complex LCDR sea tour (Battle Group staff; BB, CV, LHA, LPH Department Head; LCDR Command).

2. Advantages and Disadvantages

The principal advantage of the Mainstream career path is that it has been successful, for the most part, in matching an officer having the correct seniority and experience with an appropriate assignment at each point in his career. It has also

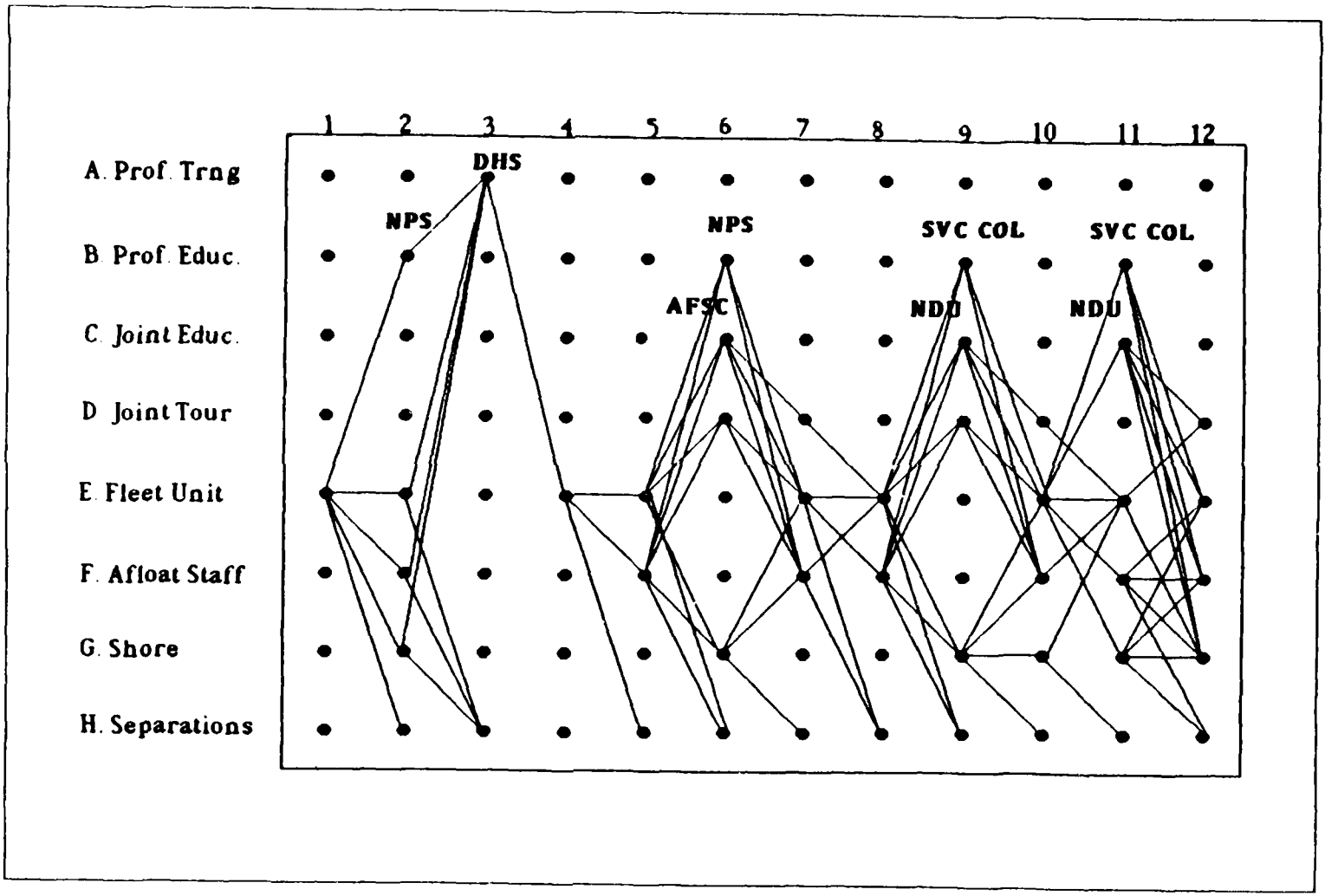

Figure 4.1 The Mainstream Career Path to Major Command.

provided the correct sea shore rotation and variety of assignments to benefit morale and retention while maintaining the emphasis on sea duty assignments.

The principal disadvantage of the Mainstream career path is its inflexibility. The primacy of sea duty assignments, more specifically the fact that they occur at very narrowly defined points in the career path, and the bottle neck which occurs at the Surface Warfare Officer's School (SWOS) Department Head course (tour 3A) are the principal contributors to the inflexibility.

This is not to argue that the Mainstream career path should be eliminated. The past 20 years have proven that, for the most part, this career path has produced officers with the right experience at the right time in their careers. The inflexibility of this career path does, however, make the SWO community susceptible to grade creep during times of lower accessions, higher attrition and or policy change.

Grade creep occurs when a billet is filled by an officer more senior than the billet requires.[6] This occurs if the pool of eligible relief officers for a particular type of billet is reduced in size or the officers are delayed by any of the above three conditions. Under such circumstances, the officers currently filling those billets are extended, thereby becoming more senior. In the mean time, the officers relieving such officers also become more senior than required for the billets. If grade creep begins in the earlier tours of the career path, it ripples through the community. If it begins in the later tours of the career path, the effect is more localized. The long term effect of grade creep is either to produce officers with sufficient time in service for promotion but without the requisite experience, or simply to age the community. To age the community means to increase the seniority of officers filling its billets.

A recent example of grade creep occurred in the SWO community in the case of at sea Department Heads. Traditionally these officers are mid to senior grade Lieutenants. As the result of a period of smaller year groups of officers and a policy change strengthening the criteria for [illegible]nce at the SWOS Department Head course, Department Heads have, [illegible], become senior-grade Lieutenants to mid-grade Lieutenant Commanders.

3. **Implementation**

The steady state stocks, tou[illegible]d transfer percentage data files for the Mainstream career path are created [illegible]d previously in the methodology chapter of this thesis.

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[6]Mygas called this 'down detail[illegible] p. 27].

In order to simulate the requirements of the DOD Reorganization Act the following changes are affected on the input data files:

1. mainstream transfer percentages in the MNSTRM30.ARD data file affected by the Act are changed to those given in Table 2;
2. mainstream tour lengths in the MNSTRM30.LED data file are changed to those given in Table 3;
3. default high and low limits are changed to reflect plus and minus 10% of the MNSTRM30.NOD stocks.

TABLE 2

CHANGES TO MAINSTREAM TRANSFER PERCENTAGES

Arc		%	
From tour:	To tour:	Old	New
6C	7D	20	50
6C	7E	45	30
6C	7F	35	20
9C	10D	20	50
9C	10E	12	8
9C	10F	68	42
11C	12D	15	50
11C	12E	35	19
11C	12F	25	16
11C	12G	25	15

TABLE 3

CHANGES TO MAINSTREAM TOUR LENGTHS

Tour	Length (quarters)	
	Old	New
7D	8	10
10D	8	12
12D	10	12

4. Results

The most dramatic change that the Goldwater-Nichols Act makes is the requirement that 50% of officers graduating from joint education institutions must serve an immediate follow-on joint duty assignment. For the sequence of tours and the transfer percentages used in the Mainstream career path, this increased emphasis on joint duty assignments results in the shifting of 30% more of the officers leaving a joint education institution away from Fleet Unit and Afloat Staff tours and towards Joint Duty tours. Therefore, those tours receiving direct input from Joint Education tours are the ones most affected by the Act. Subsequently, those tours receiving direct input from Joint Duty tours also experience change. For the Mainstream career path, the effect of this shift in emphasis is grade creep in tour 11E (CDR command, post-command sea duty). This result is discussed in the following sections.

a. Short Term

The major trend in the short term simulation is the rapid and pronounced increase in the stocks of officers in the 7^{th}, 10^{th} and 12^{th} tour Joint Duty tours (tours 7D, 10D and 12D). By the fifth year of the simulation, the stocks at tours 7D and 10D increase 200% and 350% above initial stocks respectively, and settle down to a new steady state at these levels. The stocks at tour 12D increase 16% by the 5^{th} year of the simulation. This is depicted graphically in Figure 4.2 .

The stocks of officers in the 6^{th} and 9^{th} tour Joint Duty assignments remain relatively constant because they are direct inputs from the fleet and bypass a Joint Education tour.

Figure 4.3 shows that the stocks of officers at the 10^{th} and 11^{th} tour Fleet Unit assignments (tours 10E and 11E) also change noticeably in the short term. By the 5^{th} year of the simulation, the shift toward Joint Duty assignments results in a 6% decline in the stocks at 10E (CDR command).

The shift, in combination with a two quarter increase in the length of Joint Duty tour 10D, results in the noticeable dip in stocks at tour 11E (CDR command, CDR XO, CDR Dept. Hd., CDR staff) followed by a rapid increase. This occurs because instantaneously increasing the tour length at Joint Duty tour 10D, from eight to twelve quarters, creates a four quarter period, eight quarters later, in which no officer is transfered from Joint Duty tour 10D to Fleet Unit tour 11E (see the discussion of transfers in section B of Chapter II). After the four quarter gap, the number of officers transfered from tour 10D to tour 11E increases as a result of the increase in officers assigned to Joint Duty billets discussed above.

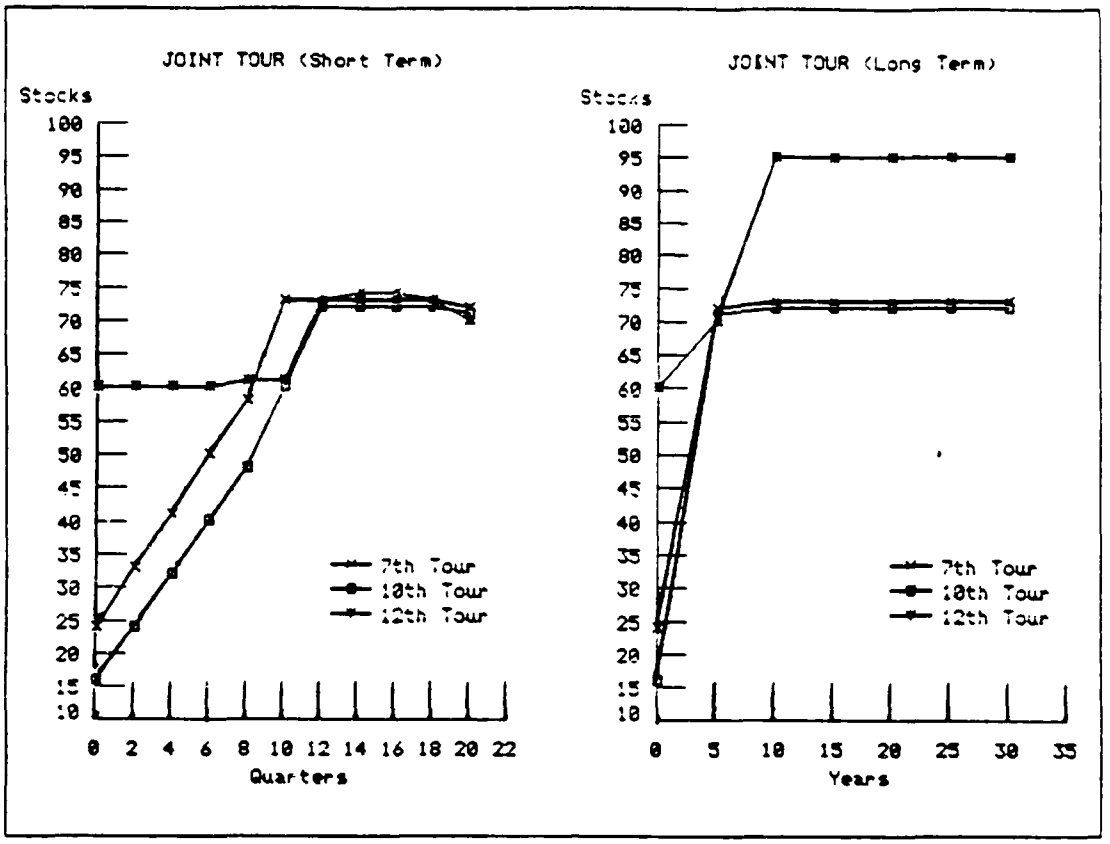

Figure 4.2 Joint Duty trends in the Mainstream career path.

Superimposed on this trend is the decline in stocks at tour 10E discussed above. Because tour 10E is nine quarters long, the effects of this decline are first observed at tour 11E after nine quarters.

As shown in Figure 4.3, after twelve quarters, the increase in transfers from tour 10D out-paces the decrease in transfers from tour 10E and results in a rapid increase in stocks at tour 11E. The overall increase at tour 11E is 25% by the 5^{th} year of the simulation.

Stocks at Fleet Unit tour 12E (Major command, ship) decline 4% by the 5^{th} year of the simulation.

The changes in stocks of officers at the 10^{th} and 11^{th} tour Afloat Staff assignments (tours 10F and 11F) are less dramatic: 6% and 5% declines respectively. The fact that stocks in tour 11F do not increase as in tour 11E can be attributed to the fact that 11F does not receive input from a Joint Duty tour and is therefore affected only by the decrease in stocks at tour 10E its only source of input (see Figure 4.1).

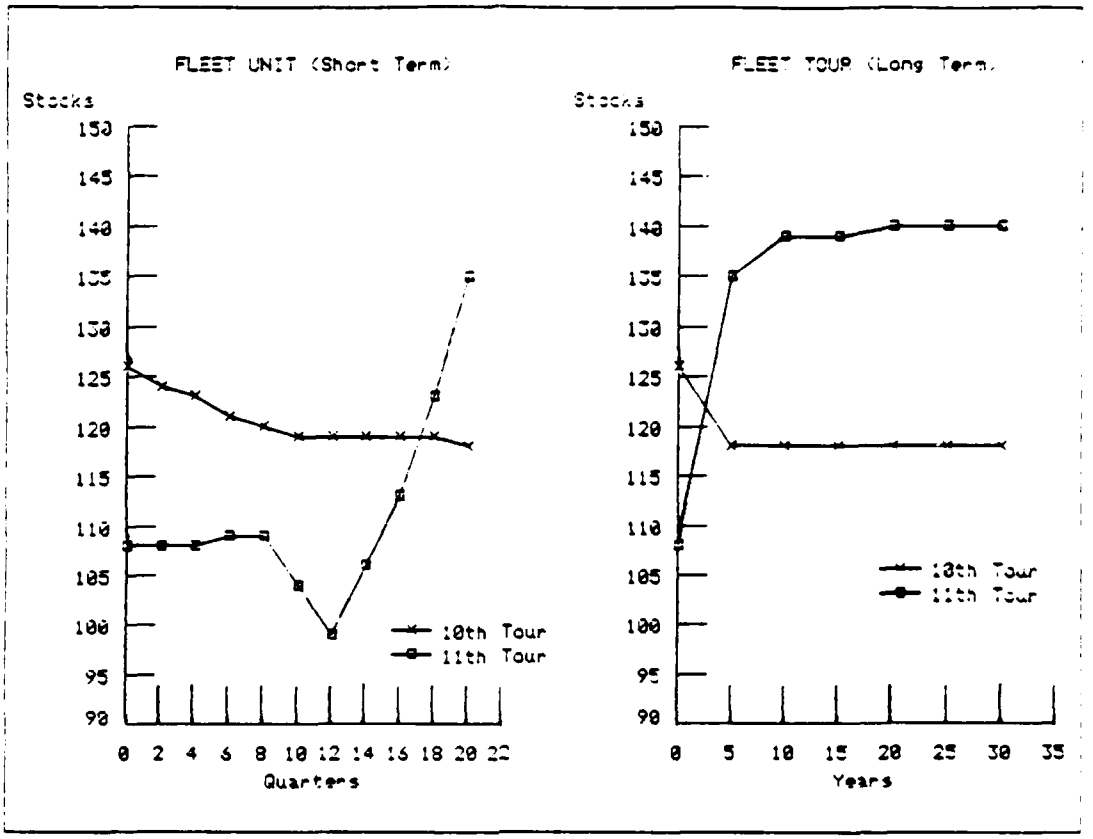

Figure 4.3 Fleet Unit trends in the Mainstream career path.

b. Long Term

The stocks of officers at Joint Duty tours 7D and 10D continue at the steady state levels achieved by the 5th year of the simulation. The stocks at Joint Duty tour 12D increase an additional 42% to reach a steady state level 58% above initial stocks by the 10th year of the simulation (see Figure 4.2).

While the stocks at Fleet Unit tour 10 (CDR command) continue at the level achieved by the 5th year of the simulation, the stocks at Fleet Unit tour 11E (CDR command, post-command sea duty) continue to increase to achieve steady state 30% above initial stocks by the 20th year of the simulation (see Figure 4.3).

The crossing of the graphs in Figure 4.3 indicates a shift in CDR commands from the 10th to the 11th tour. This shift is indicative of grade creep in CDR command billets.

The increase in stocks at tour 11E is not due to an increase in post-command stocks. CDR command is a prerequisite for the post-command billets at tour 11E, and the only source of officers to fill post-command billets is Fleet Unit tour 10E (see Figure 4.1). The effect of the Reorganization Act requirements is to reduce the stocks at tour 10E and therefore the stocks of available reliefs for the post-command billets at tour 11E.

At the same time, officers shifted away from command billets at tour 10E are delayed in serving in a command billet until tour 11E. This shift has the effect of aging the community; i.e. increasing the seniority of officers at their first opportunity to command.

C. THE EARLY DEPARTMENT HEAD CAREER PATH

1. Introduction

Both Howe [Ref. 5: p. 99] and Mygas [Ref. 7: p. 21] present an Early Department Head career path. An updated variation of this career path is investigated here with respect to the effects of the DOD Reorganization Act.

The Early Department Head career path shown in Figure 4.4 is a modification of the Mainstream career path shown in Figure 4.1 and reflects current policy regarding this career path. The differences between the Early Department Head career path and the Mainstream career path are highlighted by bold lines in Figure 4.4.

The essential element of the Early Department Head career path is the officer's attendance at the SWOS Department Head course immediately following his initial sea tour (tour 2A) and results in the officer serving his first Department Head tour (tour 3E) one tour earlier than those officers following the Mainstream career path.

Important assumptions reflected in the career path shown in Figure 4.4 are that officers following this path:

1. serve two Department Head tours (3E and 4E F);
2. attend either the Naval Postgraduate School or the Armed Forces Staff College (tours 5B or 5C) following their Department Head tours; and
3. rejoin the Mainstream career path in their 6^{th} tour.

For this analysis, it is assumed that 20% of officers completing their first Division Officer tour (1E) follow this path.

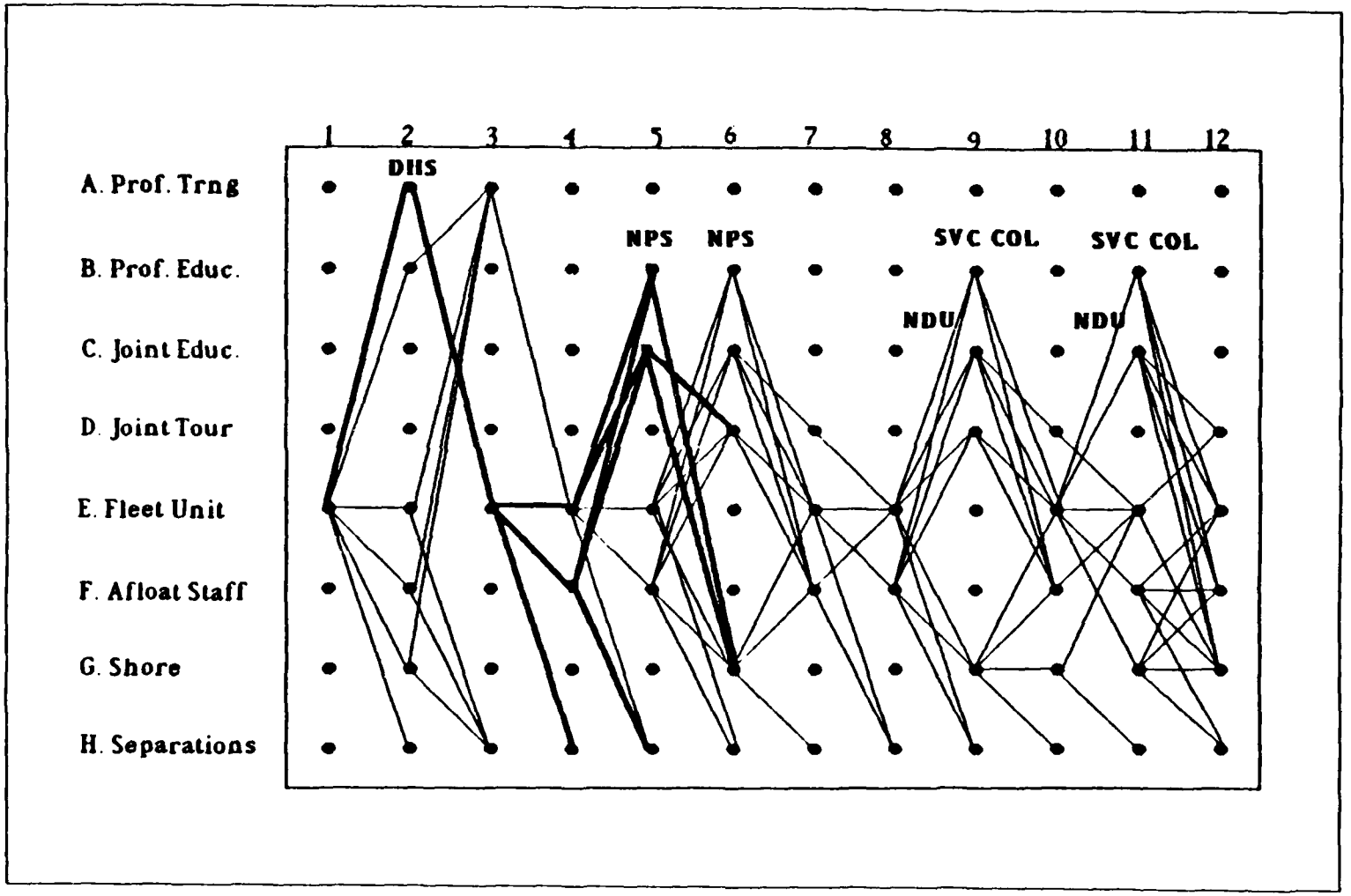

Figure 4.4 The Early Department Head Career Path.

2. **Advantages and Disadvantages**

The main advantage of this career path is that it introduces the qualified young officer to Department Head billets early enough in his career to allow him to complete both tours (3E and 4E F) while still a Lieutenant. This, in effect, counters the grade creep in Department Head billets discussed above. [Ref. 7: pp. 24-27]

An additional advantage of this career path is the earlier opportunity for the post Department Head officer to attend the Naval Postgraduate School (tour 5B). This in turn allows an immediate follow-on utilization tour (tour 6G) [Ref. 7: p. 28]. It can be seen in Figure 4.1 that in the Mainstream career path, the post Department Head graduate of the Naval Postgraduate School is delayed in serving a utilization tour until his 9^{th} tour (9G) because of the required sea duty at tours 7E F and 8E F.

Yet another advantage of the Early Department Head career path is the earlier opportunity for the post Department Head officer to attend the Armed Forces Staff College (tour 5C). A subsequent assignment to Joint Duty (tour 6D) qualifies this officer as a JSPEC and then reintroduces him into the Mainstream career path on time for a Complex LCDR or Executive Officer tour (7E F).

The main disadvantage of the Early Department Head career path is its interruption of the sea shore rotation and the effect that might have on retention. It can be seen in Figure 4.4 that, with the exception of 6 months ashore at the SWOS Department Head course (tour 2A), the officer following this career path serves the first 6 years of his career at sea. [Ref. 7: p. 29]

3. **Implementation**

To simulate the Early Department Head career path in the SWOPATH model the following changes are affected to the input data files:

1. select the MNSTRM30.NOD steady state stocks data file created for the Mainstream career path.
2. mainstream transfer percentages in the MNSTRM30.ARD data file affected by the Act are changed to those given in Table 4;
3. mainstream tour lengths in the MNSTRM30.LED data file are changed to those given in Table 5;
4. run the model to 30 years and save the steady state stocks, transfer percentages, and tour length data to files named EDH30.NOD, EDH30.ARD, and EDH30.LED respectively.

To analyze the effects of the DOD Reorganization Act on this career path the following actions are taken in the SWOPATH model:

1. select the EDH30.NOD file.

TABLE 4

CHANGES TO MAINSTREAM TRANSFER PERCENTAGES

Arc		%	
From tour:	To tour:	Old	New
1E	2A	0	20
1E	2G	30	10
2A	3E	0	100
3E	4E	0	76
3E	4F	0	19
3E	4H	0	5
4E	5B	0	10
4E	5C	0	10
4E	5E	76	48
4E	5F	19	12
4E	5H	5	20
4F	5B	0	42
4F	5C	0	33
4F	5H	0	20
5B	6G	0	100
5C	6D	0	20
5C	6G	0	80
6D	7E	50	30
6D	7F	50	70
6G	7E	40	25
6G	7F	58	70
6G	7H	2	5

2. make changes to the default high and low limit data files to reflect plus and minus 10% of the EDH30.NOD stocks.
3. make the changes listed in Table 6 to the EDH30.ARD transfer percentage file.
4. make the changes listed in Table 7 to the EDH30.LED tour length file.
5. run the SWOPATH model as described in the methodology section.

4. **Results**

The Early Department Head career path is a variation of the Mainstream career path and is, in fact, identical to the Mainstream career path after the 6th tour. The same trends observed in the analysis of the Mainstream career path are therefore observed in the analysis of the Early Department Head career path. The same shift in stocks at tours 10E and 11E occurs but to a lesser extent.

TABLE 5

CHANGES TO MAINSTREAM TOUR LENGTHS

Tour	Length (quarters)	
	Old	New
2A	0	2
3E	0	6
4F	0	6
4H	0	1
5B	0	8
5C	0	2

TABLE 6

CHANGES TO EARLY DEPARTMENT HEAD TRANSFER PERCENTAGES

Arc		%	
From tour:	To tour:	Old	New
5C	6D	20	50
5C	6G	80	50
6C	7D	20	50
6C	7E	45	30
6C	7F	35	20
9C	10D	20	50
9C	10E	12	8
9C	10F	68	42
11C	12D	15	50
11C	12E	32	19
11C	12F	28	16
11C	12G	25	15

a. Short Term

Figure 4.5 shows the rapid rise in Joint Duty stocks in the 6th, 7th, 10th, and 12th tours (6D, 7D, 10D, and 12D respectively). Tour 6D now shows a marked increase (44%) because, in the Early Department Head career path, it receives input from Joint Education tour 5C (see Figure 4.4).

TABLE 7

CHANGES TO EARLY DEPARTMENT HEAD TOUR LENGTHS

Tour	Length (quarters)	
	Old	New
6D	8	10
7D	8	10
10D	8	12
12D	10	12

Stocks at tours 7D and 10D increase 138% and 194% respectively, less than in the Mainstream career path. Steady state stocks are achieved for these two tours by the 2nd year of the simulation, one year earlier than for the Mainstream career path. The stocks at tour 12D increase 50% by the 5th year of the simulation.

Figure 4.6 shows the trends in stocks at the 10th and 11th tour Fleet Unit assignments (tours 10E and 11E). Once again, there is a shift in stocks from tour 10E to tour 11E with a 28% increase in stocks at tour 11E by the 5th year of the simulation.

The change in stocks at Major Staff tours 10F and 11F is again less dramatic; 4% and 7% respectively.

b. Long Term

Figure 4.5 shows that the stocks of officers at Joint Duty tours 7D and 10D continue at the steady state levels achieved by the 2nd year of the simulation. The stocks at Joint Duty tour 12D continue to increase until the 10th year of the simulation when they achieve steady state 2[illegible] above initial stocks.

Figure 4.6 shows that the stocks at both tour 10E and tour 11E continue at steady state levels achieved by the 5[illegible] simulation.

D. THE SINGLE DEPARTMENT HEAD TOUR CAREER PATH

1. Introduction

The Single Department H[illegible] career path is yet another variation of the Mainstream career path. The bas[illegible]re 4.7 show that it deviates from the Mainstream career path in having [illegible]ith Department Head assignment at

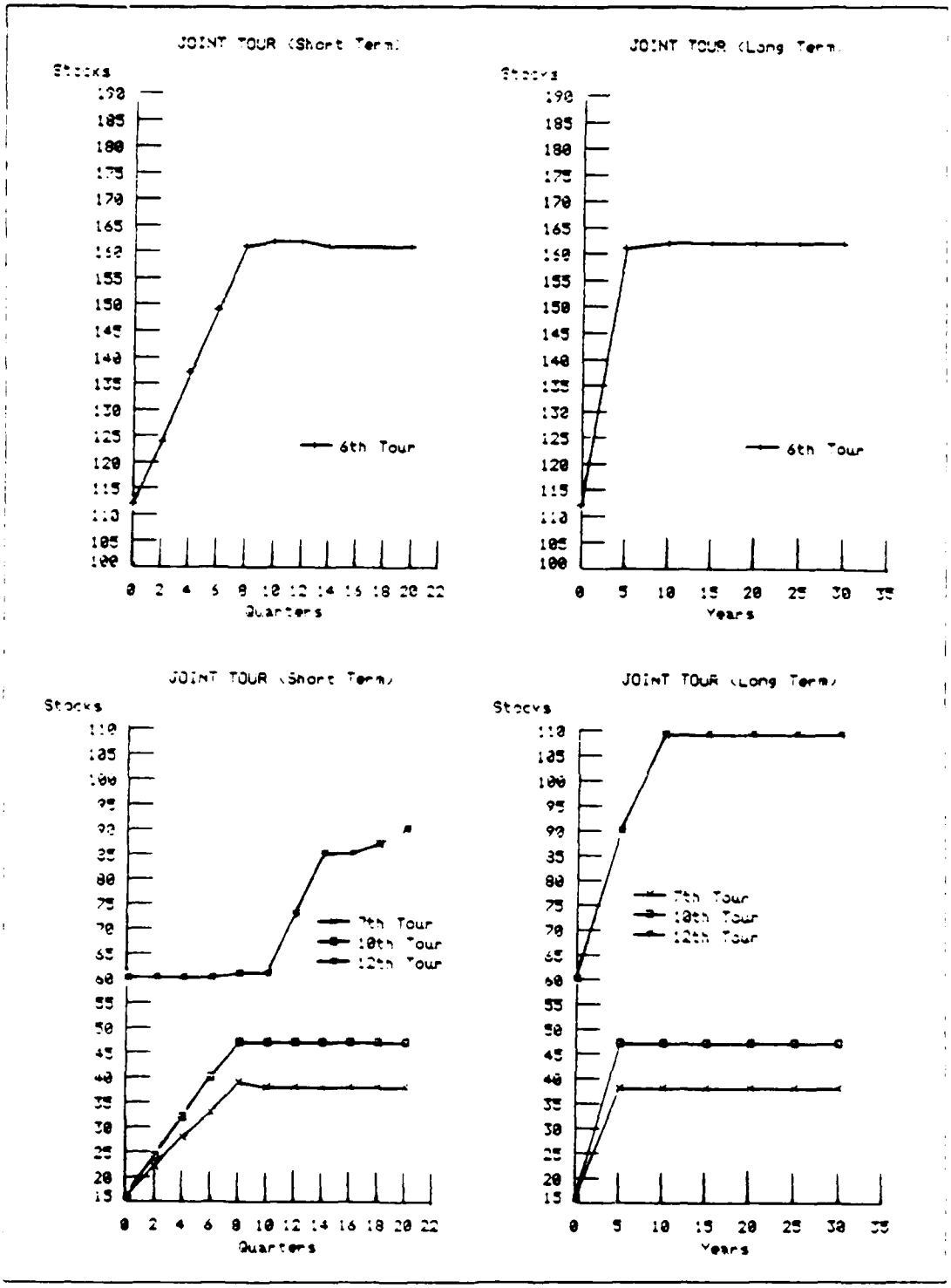

Figure 4.5 Joint Duty trends in the Early Dept. Hd. career path.

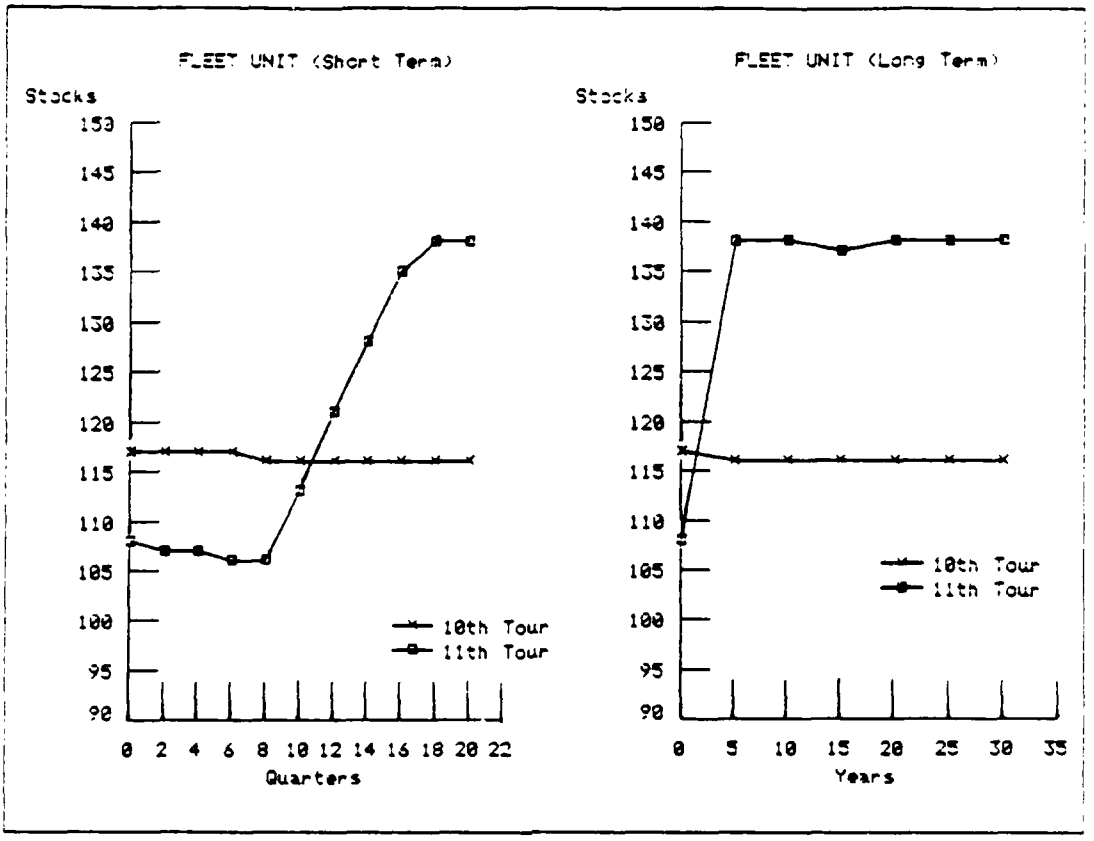

Figure 4.6 Fleet Unit trends in the Early Dept. Hd. career path.

tour 4E, followed by a 5th tour assignment at either the Naval Postgraduate School (tour 5B) or the Armed Forces Staff College (tour 5C).

The officer following this career path rejoins the Mainstream career path in his 6th tour in either a joint duty (tour 6D) assignment or a shore duty assignment (tour 6G). Thirty percent of the officers graduating from the SWOS Department Head course follow this path.

2. **Advantages and Disadvantages**

The main advantage of this career path is the fact that, like the Early Department Head career path, it counters the grade creep currently experienced in Department Head billets without deviating radically from the Mainstream career path.

As in the Early Department Head tour, an officer following this career path has the opportunity to achieve a subspecialty or to qualify as a JSPEC and to rejoin the Mainstream career path by his 6th tour.

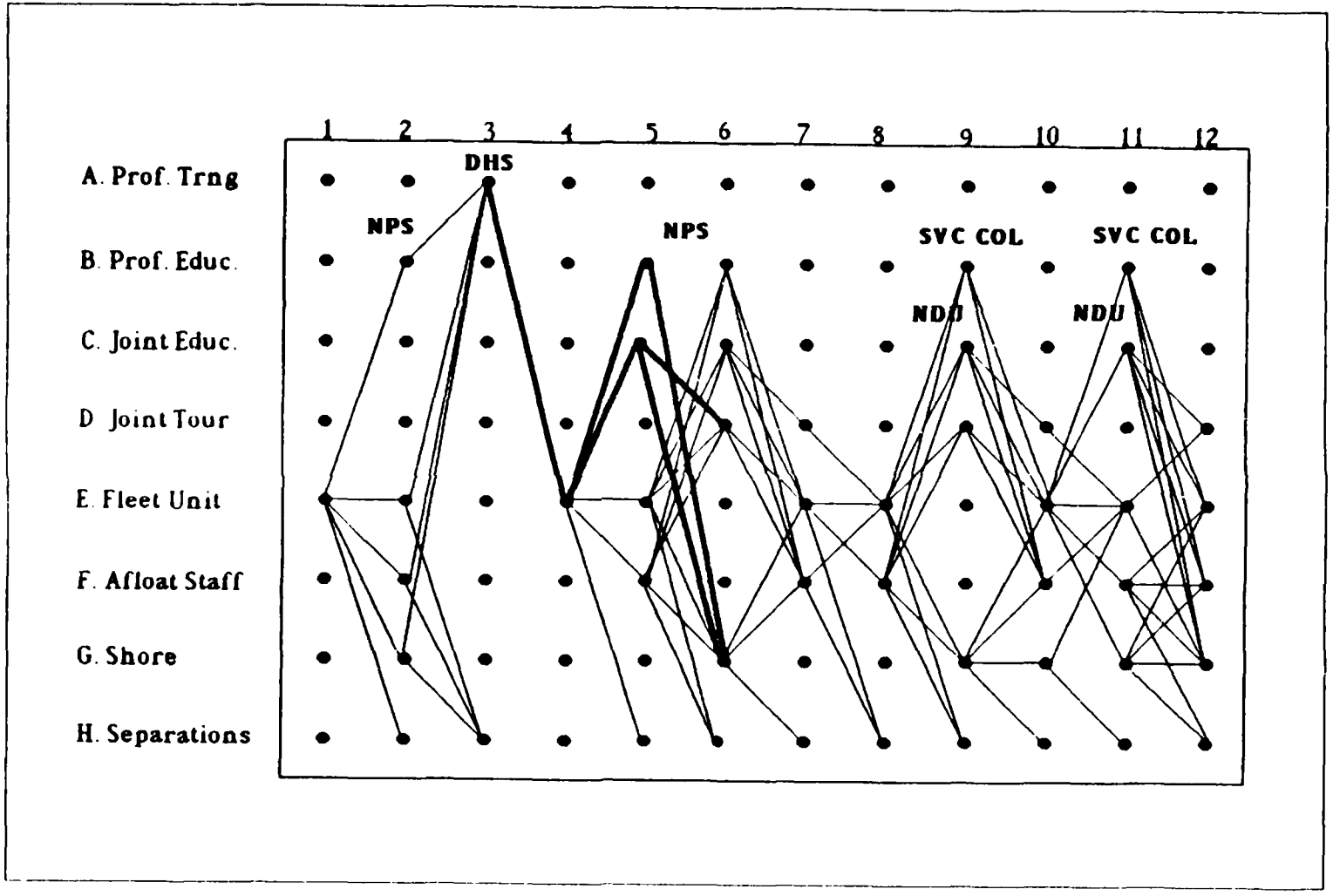

Figure 4.7 The Single Department Head Tour Career Path.

The main disadvantage of this career path is the length of time between sea tours 4E and 7E. In the Mainstream career path an officer spends 2 to 2.5 years between his second Department Head tour and his complex LCDR or XO tour.[7] In the Single Department Head Tour career path, an officer can spend as much as 4 years between his Department Head tour (4E) and his next sea duty tour (7E).

Another disadvantage of this career path concerns subspecialty utilization and designation as a JSPEC. The officer following this path and attending Naval Postgraduate School (NPS) at tour 2B would then attend the Armed Forces Staff College at tour 5C. If this officer then goes on to an immediate follow-on Joint Duty tour, the first opportunity for him to serve in a subspecialty utilization tour is tour 9G, up to 14 years after attending the Naval Postgraduate School. On the other hand, if the officer following this career path is detailed to a utilization tour (6G) following the Armed Forces Staff College (and a Joint Duty tour later in his career), he cannot be designated as a JSPEC because Joint Education and Joint Duty must be sequential for designation. One solution to this problem is not to detail officers who attend NPS in their 2nd tour to the Single Department Head career path.

3. Implementation

Simulating the Single Department Head Tour career path in the SWOPATH model presents a problem. The Department Head tour at 4E is common to both this career path and the Mainstream career path but the tour length is different for the two career paths. The SWOPATH model cannot accommodate two tour lengths at a node simultaneously. The solution to this problem is shown in Figure 4.8 .
The 30% of the officers who serve a single Department Head tour follow the path highlighted with bold lines. Tour 4E represents the single Department Head tour and has a tour length of 10 quarters.

The 70% of the officers who follow the Mainstream career path are diverted to the unused node at 4A, marked 'Dummy' in Figure 4.8 This node represents their first Department Head tour and has a tour length of six quarters. The officers thus diverted, rejoin the Mainstream career path at tour five with no actual change in their progression. In this manner, the career path shown in Figure 4.7 can be investigated using the SWOPATH model.

To simulate the Single Department Head Tour career path perform the following tasks:

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[7] Tours 5E and 7E in Figure 4.1

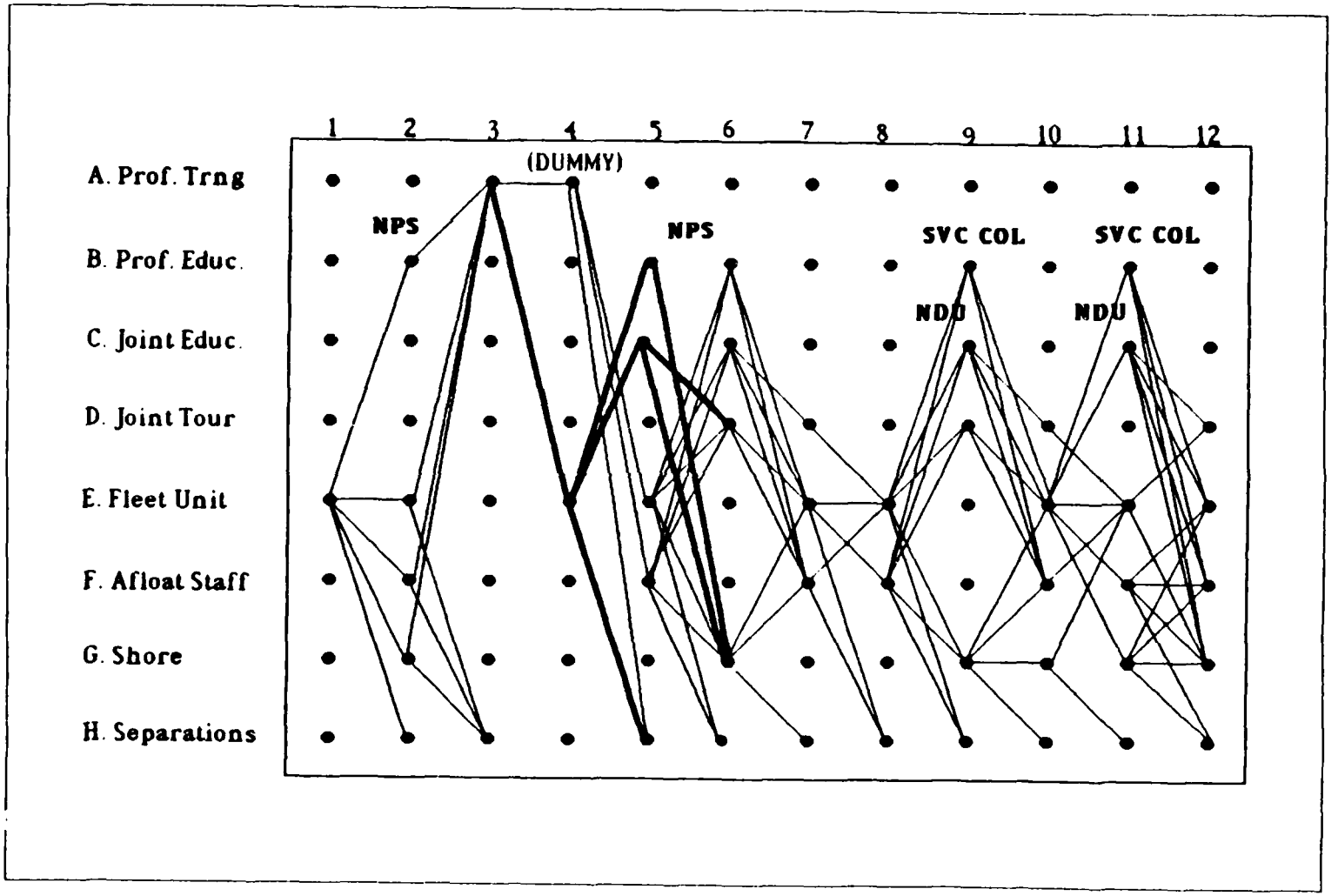

Figure 4.8 Implementing the Single Dept. Hd. Tour career path.

1. select the MNSTRM30.NOD steady state stocks data file created for the Mainstream career path;
2. make the changes listed in Table 8 to the MNSTRM30.ARD transfer percentages data file;
3. make the changes listed in Table 9 to the MNSTRM30.LED tour length data file; and
4. run the model to 30 years and save the steady state stocks, transfer percentages, and tour length data to files named SDH30.NOD, SDH30.ARD, and SDH30.LED respectively.

TABLE 8

CHANGES TO MAINSTREAM TRANSFER PERCENTAGES

Arc		%	
From tour:	To tour:	Old	New
3A	4A	0	70
3A	4E	100	30
4A	5E	0	76
4A	5F	0	19
4A	5H	0	5
4E	5B	0	55
4E	5C	0	40
4E	5E	76	0
4E	5F	19	0
5B	6G	0	100
5C	6D	0	20
5C	6G	0	80

To analyze the effects of the DOD Reorganization Act on this career path:

1. select the SDH30.NOD file.
2. make changes to the default high and low limit data files to reflect plus and minus 10% of the SDH30.NOD stocks.
3. make the changes listed in Table 6 to the SDH30.ARD transfer percentage file.
4. make the changes listed in Table 7 to the SDH30.LED tour length file.
5. run the SWOPATH model as described in the methodology section.

4. **Results**

This career path is a less radical departure from the Mainstream career path and the effects of the DOD Reorganization Act fall between those observed for the Mainstream and Early Department Head career paths. Grade creep in the CDR command billets at tours 10E and 11E occur in this career path also.

TABLE 9

CHANGES TO MAINSTREAM TOUR LENGTHS

Tour	Length (quarters)	
	Old	New
4A	0	6
4E	6	10
5B	0	8
5C	0	2

TABLE 10

CHANGES TO SINGLE DEPT. HD. TOUR TRANSFER PERCENTAGES

Arc		%	
From tour:	To tour:	Old	New
5C	6D	20	50
5C	6G	80	50
6C	7D	20	50
6C	7E	45	30
6C	7F	35	20
9C	10D	20	50
9C	10E	12	8
9C	10F	68	42
11C	12D	15	50
11C	12E	32	19
11C	12F	28	16
11C	12G	25	15

a. Short Term

Figure 4.9 shows the same pattern of rapid increase of stocks in Joint Duty tours 6D, 7D, 10D, and 12D followed by a leveling off at the 2 to 2.5 year point. The stocks of officers at tour 6D increase 73% by the 3rd year of the simulation. This is due to the input from the Joint Education tour 5C which was not a factor in the Mainstream career path. The stocks at tours 7D and 10D increase 219% and 213% respectively by the 3rd year of the simulation.

TABLE 11

CHANGES TO SINGLE DEPT. HD. TOUR TOUR LENGTHS

Tour	Length (quarters)	
6D	8	10
7D	8	10
10D	8	12
12D	10	12

Figure 4.10 shows the trends in Fleet Unit stocks at tours 7E, 10E, and 11E. The stocks at 7E show an 8% decline by the third year then rise rapidly to settle out 2% below initial stocks by the 5th year of the simulation. The dip in stocks at tour 7E is again the result of shifting emphasis toward Joint Duty assignments and is indicative of the system finding a new equilibrium after simulation of the Reorganization Act requirements. The same pattern exhibited in the Mainstream career path, indicative of grade creep, is seen in tours 10E and 11E with stocks at tour 11E reaching 21% above initial stocks by the 5th year of the simulation.

Stocks at the Afloat Staff tours 7F, 8F, and 10F again show moderate declines of 3%, 5%, and 5% respectively.

b. Long Term

Figure 4.9 shows that only tour 12D stocks have not reached steady state by the 5th year of the simulation. Tour 12D stocks achieve steady state by the 20th year.

Figure 4.10 shows that stocks at tours 7E, 10E, and 11E reach steady state by the 15th year of the simulation.

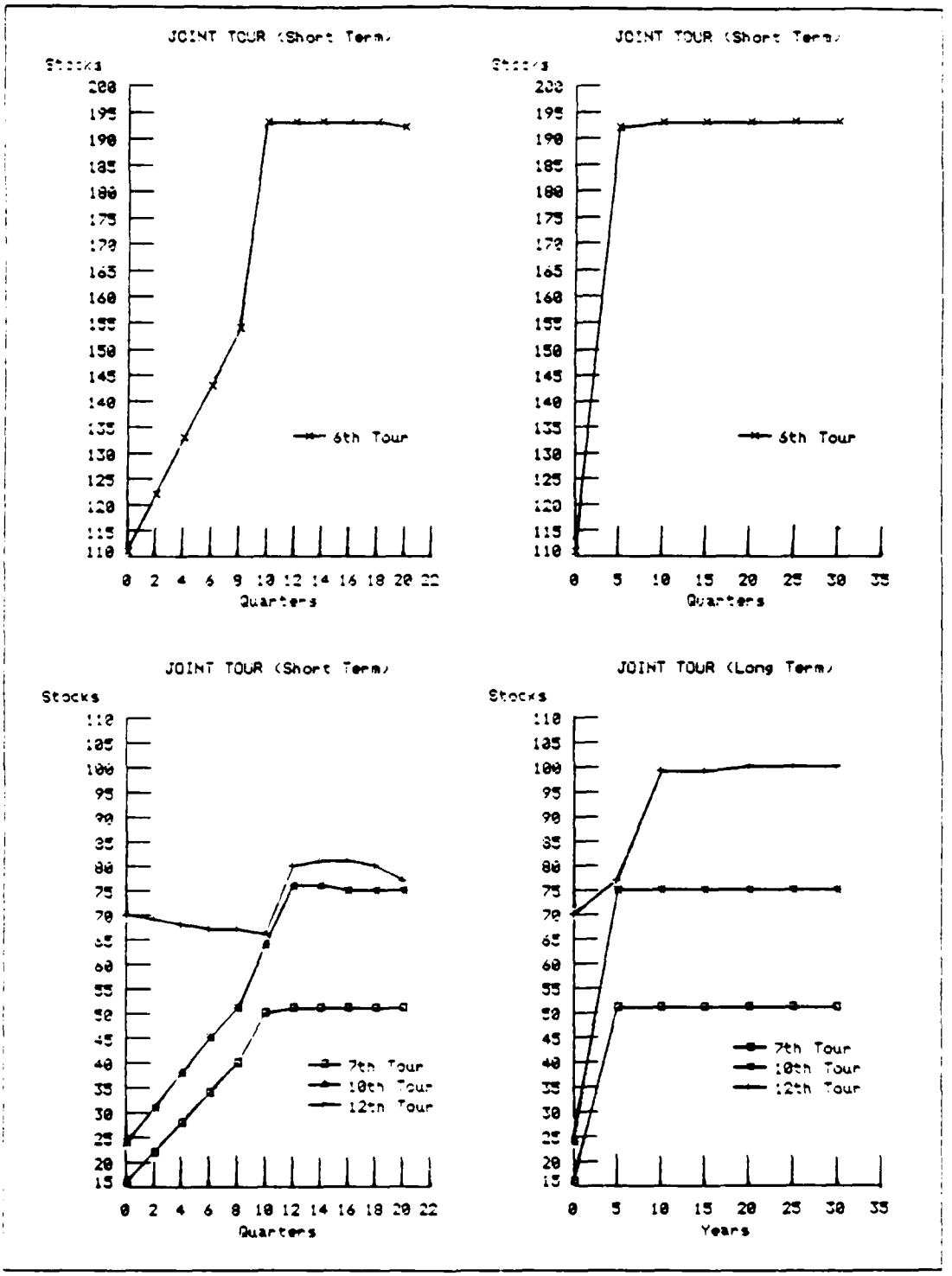

Figure 4.9 Joint Duty Trends in the Single Dept. Hd. Career Path.

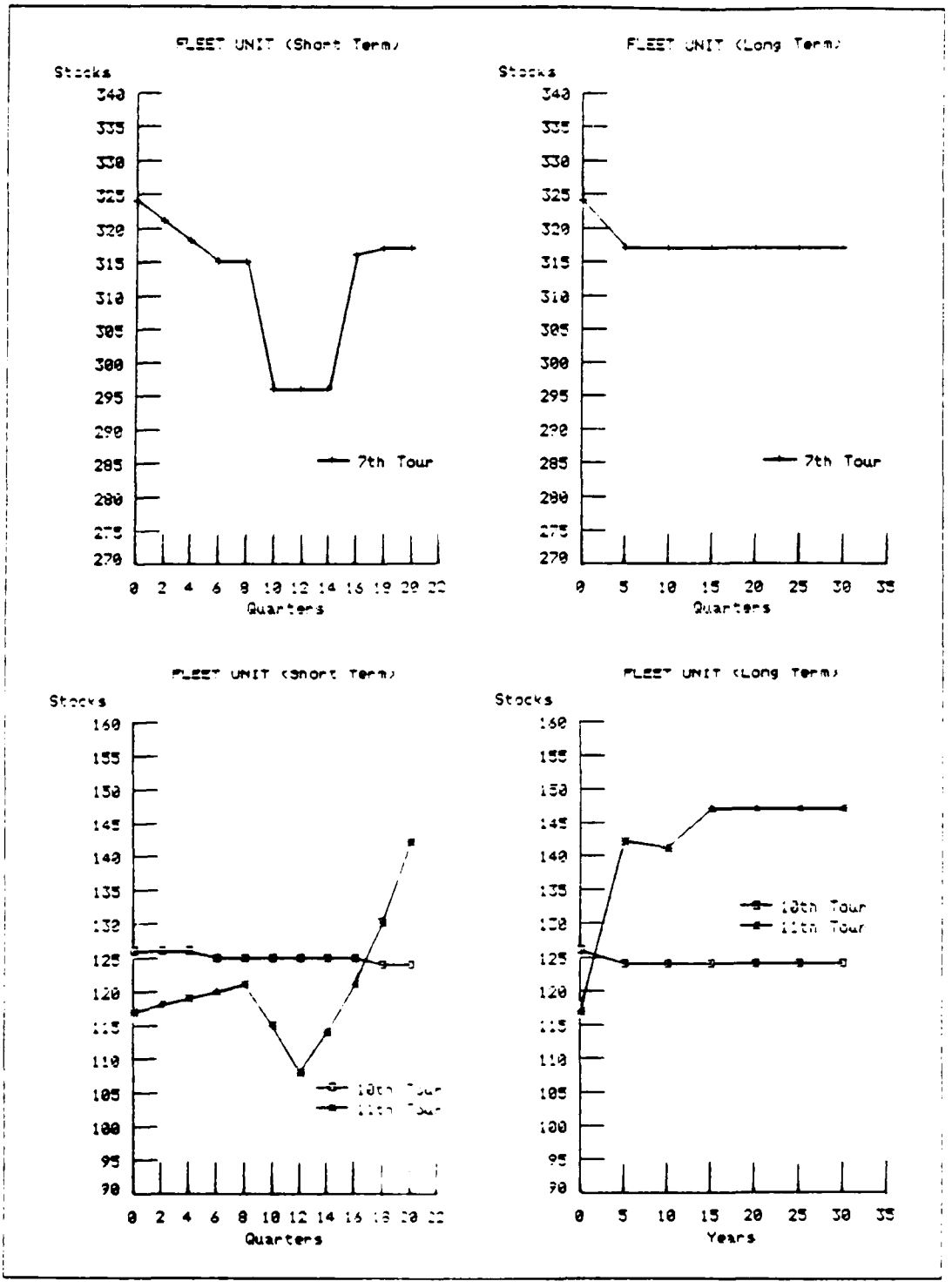

Figure 4.10 Fleet Unit Trends in the Single Dept. Hd Career Path.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

This study has reviewed the joint officer management policies mandated by the Goldwater-Nichols Department of Defense Reorganization Act and has analyzed the effects of those policies on Surface Warfare Officer career paths. The focus of the study has been to answer the following questions:

1. Can the balance between joint education and experience and SWO education and experience be achieved?
2. What are the short term and long term effects on SWO career paths of satisfying the statutory requirements of the Goldwater-Nichols Act, with or without a balance?
3. What changes to SWO career paths, if any, are necessary possible to achieve the balance?

The analysis was conducted using the SWOPATH model to simulate three Surface Warfare Officer career paths.

B. CONCLUSIONS

In all three career paths studied, a balance is achieved between joint education and experience and SWO education and experience but at a cost.

With the sequence of tours investigated in this study, the effect of the Goldwater-Nichols Act is concentrated in Joint Duty, Fleet Unit, and Afloat Staff stocks of tours following a Joint Education tour. A 30% increase in the transfer percentage from Joint Education to Joint Duty tours results in a slight decline in the stocks of officers assigned to Fleet Unit or Afloat Staff tours immediately following a Joint Education tour. It also results in a significant increase in the stocks of officers assigned to Joint Duty following a Joint Education tour. This shift achieves the goal of increasing the joint education and experience of officers but has the disadvantage of introducing grade creep at the CDR grade Fleet Unit tours. Specifically, those CDR's who would otherwise serve a CDR command tour are delayed from doing so while assigned to Joint Duty. Therefore, a new balance is achieved but at the cost of a significant shift towards Joint Duty tours and the resulting grade creep in CDR command billets.

C. RECOMMENDATIONS

Additional study of this topic could be done by focusing on a solution to the grade creep found here. This should involve investigations of alternatives to the mid-grade to senior-grade portion to the SWO career path.

Further study should also be conducted to investigate the effects of increasing Joint Education opportunities, either by increasing quotas to the colleges of the National Defense University or by qualifying the Service Colleges as Joint Education institutions.

If the SWOPATH model is to be used for further analysis, more accurate base line data for stocks, transfer percentages, and tour lengths should be developed from the information contained in the Officer Master File (OMF).

The current version of the SWOPATH model includes a separate program (UPDATE) for updating the stocks data files. The UPDATE program has the advantage of working directly on the stocks data files without going through the SWOPATH model and its change menu. The output of the UPDATE program can then be read by the SWOPATH model. The UPDATE program should be modified to allow updating of the transfer percentages, tour length, and high and low limit data files as well as the stocks files.

Ultimately, if it is envisioned that the SWOPATH model will be used extensively, the possibility of rewriting it using spreadsheet software should be pursued. Spreadsheet software would have two advantages over the current version of the model. First, spreadsheet software would allow easier expansion of the network than is possible in the current SWOPATH model and therefore make the model more responsive to changing analytical requirements. Second and finally, spreadsheet software would allow the SWOPATH model to be integrated with Data Base Management (DBM) and graphics software to provide a powerful decision support tool for the manpower analyst.

APPENDIX A
FLOW CHART OF CALCULATIONS

The chart shown in figure A.1 diagrams the logical flow of the calculations discussed in Section B of Chapter II. It is intended to provide a general idea of the calculations performed with each iteration of the simulations. For the source code from which the flow chart was derived, see Appendix G.

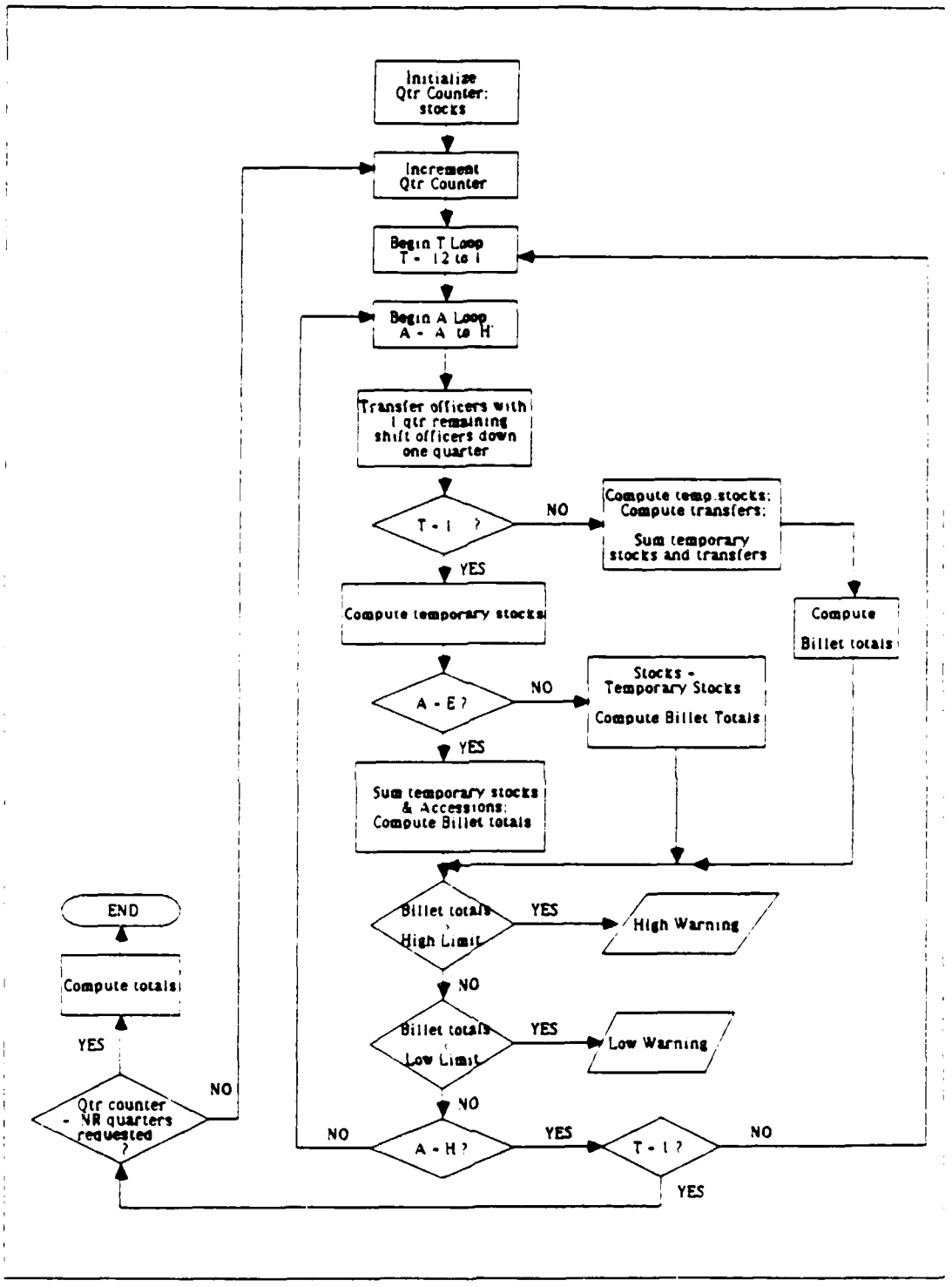

Figure A.1 SWOPATH Calculations.

APPENDIX B
MAINSTREAM CAREER PATH TRANSFER PERCENTAGES

TABLE 12

MAINSTREAM TRANSFER PERCENTAGES

ARC	%	ARC	%	ARC	%
1EE	25	7DE	100	11BE	42
1EF	10	7EE	50	11BF	30
1EG	30	7EF	48	11BG	28
1EH	25	7EH	02	11CD	15
		7FE	98	11CE	35
2BA	100	7FH	02	11CF	50
				11CG	15
2EA	50	8EB	15	11ED	50
2EH	50	8EC	10	11EG	50
2FA	50	8ED	10	11FE	50
2FH	50	8EG	60	11FF	10
2GA	65	8EH	05	11FG	30
2GH	35	8FB	15	11FH	10
		8FC	10	11GE	50
3AE	100	8FD	10	11GF	10
		8FG	60	11GG	30
4EE	76	8FH	05	11GH	10
4EF	19				
4EH	05	9BE	12		
		9BF	88		
5EB	10	9CD	20		
5EC	10	9CE	12		
5ED	10	9CF	68		
5EG	55	9DE	12		
5EH	15	9DF	88		
5FB	10	9GE	12		
5FC	10	9GF	88		
5FD	10	9GG	35		
5FG	55	9GH	15		
5FH	15				
		10DE	100		
6BE	40	10EB	05		
6BF	60	10EC	02		
6CD	20	10EE	10		
6CE	45	10EF	50		
6CF	35	10EG	30		
6DE	50	10EH	03		
6DF	50	10FE	12		
6GE	40	10FH	55		
6GF	58	10GE	03		
6GH	02	10GH	95		

APPENDIX C
MAINSTREAM CAREER PATH TOUR LENGTHS

TABLE 13

MAINSTREAM TOUR LENGTHS

TOUR	LENGTH	TOUR	LENGTH	TOUR	LENGTH
1E	10	7D	8	11B	4
		7E	6	11C	4
2B	8	7F	6	11E	9
2E	6	7H	1	11F	8
2F	6			11G	8
2G	8	8E	7	11H	1
2H	1	8F	6		
		8H	1	12D	10
3A	2			12E	8
		9B	4	12F	8
4E	6	9C	4	12G	8
		9D	10	12H	1
5E	6	9G	8		
5F	6	9H	1		
5H	1				
		10D	8		
6B	6	10E	9		
6C	2	10F	8		
6D	8	10G	8		
6E	8	10H	1		
6G	8				
6H	1				

APPENDIX D
SWOPATH MAIN PROGRAM

```
PROGRAM SWOPATH;

{ This is the main program.  Here all global variables are defined,
   all procedures are forward referenced, and all include files are
   called.  The remainder of the parts that make up the model are
   subroutines, called procedures, which the main program calls as
   necessary to run the model. }

TYPE

     One_Dim_Real = ARRAY [(1..12] OF REAL;
     Two_Dim_Int = ARRAY [1..12,'A'..'H'] OF INTEGER;
     Two_Dim_Real = ARRAY [1..12,'A'..'H'] OF REAL;
     Tre_Dim_RealCH = ARRAY [1..12,'A'..'H','A'..'H'] OF REAL;
     Tre_Dim_RealNR = ARRAY [1..12,'A'..'H',1..16] OF REAL;
     AString = STRING [80];
     STR_25 = STRING [25];
     One_Dim_StrNR = ARRAY [1..16] OF STR_25;
     One_Dim_StrCH = ARRAY ['A'..'H'] OF STR_25;

VAR

     Tour_sum: One_Dim_Real;
     Tour,                          { label for which tour }
     TLength: One_Dim_StrNR;        { label for length in quarters)
     Activity: One_Dim_StrCH;       { label for activity }
     HiLimit,                       { max number of officers by billet node }
     LoLimit,                       { min number of officers by billet node }
     Temp_Billet_Total,             { temporary number at each billet node }
     Billet_Total: Two_Dim_Real;    { sum of officers at each billet node }
     New_Length,                    { new length of tour (to be changed to ) }
     Old_Length,                    { old billet length (for record purposes) }
     Billet_Length: Two_Dim_Int;    { actual billet length }
     Transfer_Path: Tre_Dim_RealCH; { percent of officers to be transferred }
     Path_total,                    { percent totals  of transfer paths }
     Temp_Billet_Node,              { temporary number of officers at each node }
     Billet_Node: Tre_Dim_RealNR;   { number of officers at node by quarters left
}
     Accessions,                    { number of officer accessions }
     Tempcount,
     NumberSeconds,
     X,
     Y,
     T,                             { tour number from 1 to 12 }
     L,                             { quarters left from 1 to 16 }
     Total,
     NRQuarters,                    { how many quarters model is to run }
     NRYears,                       { value established by user }
     Quarter,                       { counts from 1 to 4 }
     QtrCount,                      { variable keeps track of # of iterations }
     YrCount: INTEGER;              { variable keeps track of nr of years }
     K,                             { used for activity }
     A,                             { used for activity }
     Answer,
     Choice,
     Reinit,                        { used in years to indicate reinitialize }
     Display,                       { answer to choice of display }
     Skip,
     First,                         { Used to input info to Correct_choice }
     Last: CHAR;                    { Used to input info to Correct_choice }
     Stop_calc_A,
     Stop_calc_T,                   { limit warning boolean }
     Final_totals,
```

```
    Violation,                  { if limits violated }
    Toomany,                    { hi limit }
    Toofew,                     { lo limit }
    Change,                     { desire to change }
    Initial,                    { initialize values }
    All_finished,               { completely finished with program }
    Finished,                   { finished with particular section }
    Ready,
    Replace,                    { activates replacemt of initial data }
    Review,                     { look over display selections }
    Ok_answer,                  { Used in correct_answer procedure }
    Ok_choice: BOOLEAN;         { Used in correct_choice procedure }
    File_var,
    Output_name,                {                              }
    Nodedata,                   {  these are all               }
    Arcdata,                    {   used in data file          }
    Lengdata,                   {     creation and transfer    }
    Hilidata,
    Lolidata: Str_25;           { Data file variable names }
    Choice_zero,
    Chg_var : AString;
    Temporary:REAL;
    Data_file: TEXT;

(.pa){ forward references for all procedures }

PROCEDURE Logo; FORWARD;

PROCEDURE Dirlist; FORWARD;
PROCEDURE Initialize ; FORWARD;
PROCEDURE Initialize_nodes ; FORWARD;
PROCEDURE Initialize_arcs ; FORWARD;
PROCEDURE Initialize_lengths;  FORWARD;
PROCEDURE Initialize_hilimits; FORWARD;
PROCEDURE Initialize_lolimits; FORWARD;
PROCEDURE Initialize_labels; FORWARD;

PROCEDURE Selection_menu; FORWARD;
PROCEDURE Review_selections ; FORWARD;
PROCEDURE Calculations ; FORWARD;
PROCEDURE Ask_for_years ; FORWARD;

PROCEDURE All_billet_totals; FORWARD;
PROCEDURE Billet_totals (VAR T: INTEGER;
                                    VAR A: CHAR     ); FORWARD;
PROCEDURE High_warning; FORWARD;
PROCEDURE Low_warning; FORWARD;

PROCEDURE Changes; FORWARD;
PROCEDURE Change_accessions; FORWARD;
PROCEDURE Change_arcs; FORWARD;
PROCEDURE Change_length; FORWARD;
PROCEDURE Change_hilimits; FORWARD;
PROCEDURE Change_lolimits; FORWARD;

PROCEDURE Dchoices; FORWARD;
PROCEDURE Dchanges; FORWARD;
PROCEDURE From_pathscrn; FORWARD;
PROCEDURE To_pathscrn; FORWARD;

PROCEDURE Disp_assign; FORWARD;
PROCEDURE Disp_tours; FORWARD;
PROCEDURE Disp_paths_from; FORWARD;
PROCEDURE Disp_paths_to; FORWARD;
PROCEDURE Disp_billets; FORWARD;

PROCEDURE Node_dump; FORWARD;
PROCEDURE Arc_dump; FORWARD;
PROCEDURE Length_dump; FORWARD;
PROCEDURE Hilim_dump; FORWARD;
PROCEDURE Lolim_dump; FORWARD;

PROCEDURE Invalid_answer; FORWARD;
PROCEDURE Wrong_answer; FORWARD;
PROCEDURE Correct_choice (VAR Choice, First, Last: CHAR;
```

```
                                        VAR OK_choice: BOOLEAN); FORWARD;
PROCEDURE Correct_answer (VAR Answer: CHAR;
                                        VAR OK_answer: BOOLEAN); FORWARD;
PROCEDURE Another_change; FORWARD;
PROCEDURE Strip (VAR File_var: STR_25); FORWARD;
PROCEDURE Blankline (X, Y: INTEGER); FORWARD;

PROCEDURE Save_data ; FORWARD;
PROCEDURE Replace_data; FORWARD;

{.pa} { link up all include files }

     {$I ibmUTILS }

     {$I Logo}

     {$I Initdata}

     {$I Selectio}

     {$I Calculat}

     {$I Totals}

     {$I Chgdata}

     {$I Screens}

     {$I Displays}

     {$I Datadump}

     {$I Answers}

     {$I Stordata}


{.pa}
{  The beginning of the MAIN Program  }

BEGIN

   Accessions := 350;
   Tempcount := 0;
   NRYears := 0;
   NRQuarters := 0;
   Quarter := 0;
   YRcount := 0;
   Review := false,     { to skip sample selections the first time }
   Initial := true; { to initialize the data the first time }
   New_Length [ T, A ] := Billet_Length [ T, A ];
   Logo;

      IF Initial THEN
      BEGIN { initial if }
      Initialize;
      Change_accessions;
      Initial := false;  { to prevent program from reinitializing}
      END; { initialize if}

      REPEAT    { repeat loop until allfinished }
      All_finished := false;  { to ensure that we are not all finished }
      Ready :=  false;    { establish that we are not ready for calcul }
      Change := false;    { establish that initially we do not change }

         IF NOT All_finished THEN Selection_menu;

      UNTIL All_finished = true;

   Save_data;
   Clearscreen;
   {GotoRC ( 12, 13);}              { deleted 05 November 1987 -- TFS }
   {Color ( white, magenta);}
   {WRITELN ('              Have a nice day!              ');}
   {Color ( yellow, blue);}

END.  { SHOPATH main program }
```

APPENDIX E
SWOPATH LOGO INCLUDE FILE

```
{*************************************************************************
*************************************************************************}
{  This file contains the procedure

      Logo

}

PROCEDURE Logo;

      { This procedure calls up the initial screen logo.}

BEGIN

   ClearScreen;
   Color (white,blue);
   ClearScreen;
   Color(white, magenta);
   Center(10,'SWOPATH');
   (Center(12,'The Surface Warfare Officer');)
   (Center(14,'Career Path Model');)
   Center (18,'Version 1.2');          { Be sure to change version number }
   (Center (20,'20 October 1985');)
   Color(white, blue);                    { and date if modifications are made }
   GotoRC (23, 1);
   DELAY (1500);

END; {Logo}
```

APPENDIX F
SWOPATH INITIALIZATION INCLUDE FILE

```
{*************************************************************************
*************************************************************************}
{ This file contains the following procedures

      Initialize
      Initialize_nodes
      Initialize_arcs
      Initialize_lengths
      Initialize_labels      { modified 11/05/87 -- TFS }
      Initialize_hilimits
      Initialize_lolimits
      DirList
}

PROCEDURE Initialize;

{ This procedure provides the displays and mechanics to call up
   the data initialization procedures }

VAR

   Ok: BOOLEAN;
   X,Y : INTEGER;
   Default : Str_25;

BEGIN

   Finished := false;

      IF Initial THEN
      BEGIN
      Nodedata := 'Nodes';
      Arcdata := 'Arcs';
      Lengdata := 'Length';
      Hilidata := 'Hilimit';
      Lolidata := 'Lolimit';

         REPEAT { until finished }
         Chg_var :=
         'Do you want to change the input data files from those listed below?';
         Choice_zero :='No changes wanted/finished changes.';
         Dchanges;

            IF Choice = '0' THEN Finished := true

            ELSE
            BEGIN
            Clearscreen;
            GotoRC (5, 1);
            WRITELN ('  Remember, you must choose a data file that you have ');
            WRITELN ('      previously saved.  Those are listed below.');
            WRITELN;
            Color (red, white );
            Dirlist;
            Color (white, blue);
            WRITELN;WRITELN;
            GotoRC (11, 15);
            WRITELN ('   Enter the input filename');
            Color (blue, white);
            GotoRC (13, 15);
            WRITELN (' typed exactly as listed above,');
            Color (white, blue);
            GotoRC (15, 15);
            WRITELN (' that you choose to use: ');

               REPEAT   { Ok true }
```

```
            IF Choice = '1' THEN Default := 'Nodes';
            IF Choice = '2' THEN Default := 'Arcs';
            IF Choice = '3' THEN Default := 'Length';
            IF Choice = '4' THEN Default := 'Hilimit';
            IF Choice = '5' THEN Default := 'Lolimit';

         GotoRC (20,15);
         WRITE ('Type  ', Default,'  if you want to exit back to menu.');
         Blankline (15, 40);
         GotoRC (15, 40);
         READ (File_var);

            IF Choice = '1' THEN File_var := CONCAT (File_var,'.nod');
            IF Choice = '2' THEN File_var := CONCAT (File_var,'.ard');
            IF Choice = '3' THEN File_var := CONCAT (File_var,'.led');
            IF Choice = '4' THEN File_var := CONCAT (File_var,'.hid');
            IF Choice = '5' THEN File_var := CONCAT (File_var,'.lod');

         ASSIGN (Data_file, File_var);{This procedure determines if there }
         {$I-} RESET (Data_file) {$I+};{is such a file as selected by user.}
         Ok := (IOresult = 0);
         Strip (File_var);

            IF NOT Ok THEN
            BEGIN
            Blankline (24, 1);
            Color (white, red);
            WRITE (' Cannot find file ', File_var,' please try again.');
            DELAY (1500);
            Color (white, blue);
            Blankline (24, 1);
            END; { Ok IO result if }

         UNTIL Ok = True;

         IF Choice = '1' THEN Nodedata := File_var;
         IF Choice = '2' THEN Arcdata  := File_var;
         IF Choice = '3' THEN Lengdata := File_var;
         IF Choice = '4' THEN Hilidata := File_var;
         IF Choice = '5' THEN Lolidata := File_var;

      END; { if choice = 0 }

   UNTIL Finished = true;

Initialize_labels;
Initialize_nodes;
Initialize_arcs;
Initialize_lengths;
Initialize_hilimits;
Initialize_lolimits;
Final_totals := true;
All_billet_totals;
Blankline (24,1);
END; {if Initial }

IF NOT Initial THEN
BEGIN

   REPEAT { Until finished true }
   Chg_var := 'Which data do you desire to reinitialize?';
   Choice_zero := 'None/finished reinitializing data.';
   Dchanges;

      IF NOT Ok_choice THEN Initialize;

      IF Choice = '0' THEN Finished := true;

      IF Choice = '1' THEN
      BEGIN
      Initialize_nodes;
      Arcdata := CONCAT (Arcdata,'.ard');
      Lengdata := CONCAT (Lengdata,'.led');
      Hilidata := CONCAT (Hilidata,'.hid');
      Lolidata := CONCAT (Lolidata,'.lod');
      END;  { If choice 1 }
```

```
            IF Choice = '2' THEN
            BEGIN
            Initialize_arcs;
            Nodedata := CONCAT (Nodedata,'.nod');
            Lengdata := CONCAT (Lengdata,'.led');
            Hilidata := CONCAT (Hilidata,'.hid');
            Lolidata := CONCAT (Lolidata,'.lod');
            END;  { If choice 2 }

            IF Choice = '3' THEN
            BEGIN
            Initialize_lengths;
            Nodedata := CONCAT (Nodedata,'.nod');
            Arcdata := CONCAT (Arcdata,'.ard');
            Hilidata := CONCAT (Hilidata,'.hid');
            Lolidata := CONCAT (Lolidata,'.lod');
            END;  { If choice 3 }

            IF Choice = '4' THEN
            BEGIN
            Initialize_hilimits;
            Nodedata := CONCAT (Nodedata,'.nod');
            Arcdata := CONCAT (Arcdata,'.ard');
            Lengdata := CONCAT (Lengdata,'.led');
            Lolidata := CONCAT (Lolidata,'.lod');
            END; {If choice 4 }

            IF Choice = '5' THEN
            BEGIN
            Initialize_lolimits;
            Nodedata := CONCAT (Nodedata,'.nod');
            Arcdata := CONCAT (Arcdata,'.ard');
            Lengdata := CONCAT (Lengdata,'.led');
            Hilidata := CONCAT (Hilidata,'.hid');
            END; { if choice 5 }

         UNTIL Finished = true;

      Final_totals := true;
      All_billet_totals;
      Clearscreen;

      END; { if NOT initial }
END; { Initialize procedure}

(*****************************************************************************
*****************************************************************************)

{.pa}

PROCEDURE Initialize_nodes;

  { This procedure reads assignment data from
     a data file on the disk }

BEGIN
   Blankline (23, 10);
   GotoRC (23, 1);
   WRITE ('  Initializing the number of officers at nodes ',
                        '','using the file: ', Nodedata);
   Nodedata := CONCAT (Nodedata,'.nod');
   ASSIGN (Data_file,Nodedata);
   RESET (Data_file);

      WHILE NOT EOF(Data_file) DO
      BEGIN
      READ (Data_file, T );

         IF NOT EOF(Data_file) THEN
         BEGIN
         READ (Data_file, Skip);
         READ (Data_file, A );
```

```
            READ (Data_file, Skip);
            READ (Data_file, L );
            READ (Data_file, Skip);
            READLN (Data_file, Billet_node [ T, A , L ]);
            END;  { if not end of file }

         END; { end while not end of file }

      CLOSE (Data_file);

   END;  { Initialize nodes }

   {*************************************************************************
   *************************************************************************}

   {.pa}

   PROCEDURE Initialize_Arcs;

   { This procedure reads transfer path percentages from
      a data file on the disk }

   VAR

      T,
      L: INTEGER;
      A,
      K: CHAR;
      Data_file: TEXT;

   BEGIN

      Blankline (23, 10);
      GotoRC (23, 1);
      WRITE ('  Initializing the transfer path percentages ',
                                    '','using the file: ',Arcdata);
      Skip := ' ';
      Arcdata := CONCAT (Arcdata, '.ard');
      ASSIGN (Data_file,Arcdata);
      RESET (Data_file);

         WHILE NOT EOF(Data_file) DO
         BEGIN
         READ (Data_file,T);

            IF NOT  EOF(Data_file) THEN
            BEGIN
            READ (Data_file, Skip);
            READ (Data_file, A);
            READ (Data_file, Skip);
            READ (Data_file, K);
            READLN (Data_file,Transfer_Path [ T, A, K ]);
            END;  { end if not end of file }

         END;  { end while not end of file }

      CLOSE (Data_file);

   END;  { Initialize arcs }

   {*************************************************************************
   *************************************************************************}


   {.pa}

   PROCEDURE Initialize_lengths;

   { This procedure reads the assignment tour length data
      from a data file on the disk }

   VAR

      T: INTEGER;
      A: CHAR;
      Data_file: TEXT;

   BEGIN

      Blankline (23, 10);
      GotoRC (23, 1);
```

```
   WRITE (' Initializing assignment tour lengths using the file: ', Lengdata);
   Lengdata := CONCAT (Lengdata, '.led');
   ASSIGN (Data_file, Lengdata);
   RESET (Data_file);

      WHILE NOT EOF(Data_file) DO
      BEGIN
      READ (Data_file, T );

         IF NOT EOF(Data_file) THEN
         BEGIN
         READ (Data_file, Skip);
         READ (Data_file, A );
         READLN (Data_file,Billet_length [ T, A ]);
         END; {end if not end of file }

      END; { end while not end of file }

   CLOSE (Data_file);

END;  { initialize lengths }

{*****************************************************************************
*****************************************************************************}

{.pa}

PROCEDURE Initialize_labels; { modified 11/05/87 -- TFS }

{ This procedures establishes the display labels for
   tours, activities, and quarters left }

BEGIN

   Tour [1] := 'First Tour ';
   Tour [2] := 'Second Tour ';
   Tour [3] := 'Third Tour ';
   Tour [4] := 'Fourth Tour ';
   Tour [5] := 'Fifth Tour ';
   Tour [6] := 'Sixth Tour ';
   Tour [7] := 'Seventh Tour ';
   Tour [8] := 'Eighth Tour ';
   Tour [9] := 'Ninth Tour ';
   Tour [10] := 'Tenth Tour ';
   Tour [11] := 'Eleventh Tour ';
   Tour [12] := 'Twelfth Tour ';
   Activity [ 'A' ] := 'Prof Trng ';    { modified 11/05/87 -- TFS }
   Activity [ 'B' ] := 'Prof Educ ';
   Activity [ 'C' ] := 'Joint Educ ';
   Activity [ 'D' ] := 'Joint Tour ';
   Activity [ 'E' ] := 'Fleet Unit ';
   Activity [ 'F' ] := 'Afloat Staff ';
   Activity [ 'G' ] := 'Shore ';
   Activity [ 'H' ] := 'Separation ';
   TLength [ 1 ] := ' with  1 qtr  left';
   TLength [ 2 ] := ' with  2 qtrs left ';
   TLength [ 3 ] := ' with  3 qtrs left';
   TLength [ 4 ] := ' with  4 qtrs left';
   TLength [ 5 ] := ' with  5 qtrs left';
   TLength [ 6 ] := ' with  6 qtrs left';
   TLength [ 7 ] := ' with  7 qtrs left';
   TLength [ 8 ] := ' with  8 qtrs left';
   TLength [ 9 ] := ' with  9 qtrs left';
   TLength [ 10 ] := ' with 10 qtrs left';
   TLength [ 11 ] := ' with 11 qtrs left';
   TLength [ 12 ] := ' with 12 qtrs left';
   TLength [ 13 ] := ' with 13 qtrs left';
   TLength [ 14 ] := ' with 14 qtrs left';
   TLength [ 15 ] := ' with 15 qtrs left';
   TLength [ 16 ] := ' with 16 qtrs left';

END; { Initialize labels }

{*****************************************************************************
```

```
*****************************************************************************)
(.pa)

PROCEDURE Initialize_hilimits;

{ This procedure reads high limit data from a data file on the disk }

VAR

   T: INTEGER;
   A: CHAR;
   Data_file: TEXT;

BEGIN

   Blankline (23, 10);
   GotoRC (23, 1);
   WRITE ('  Initializing the high limits using the file: ', Hilidata) ;
   Hilidata := CONCAT (Hilidata,'.hid');
   ASSIGN (Data_file, Hilidata);
   RESET (Data_file);

      WHILE NOT EOF(Data_file) DO
      BEGIN
      READ (Data_file, T );

         IF NOT EOF(Data_file) THEN
         BEGIN
         READ (Data_file, Skip);
         READ (Data_file, A );
         READ (Data_file, Skip);
         READLN (Data_file, HiLimit [ T, A ]);
         END; { end if not end of file if  }

      END; { end while not EOF loop }

   CLOSE (Data_file);

END; { Hilimit procedure }

{*****************************************************************************
*****************************************************************************)

(.pa)

PROCEDURE Initialize_lolimits;

{ This procedure reads low limit data from a disk file }

VAR

   T: INTEGER;
   A: CHAR;
   Data_file: TEXT;

BEGIN

   Blankline (23, 10);
   GotoRC (23, 1);
   WRITE ('  Initializing Low Limits using the file: ', Lolidata);
   Lolidata := CONCAT (Lolidata, '.lod');
   ASSIGN (Data_file, Lolidata);
   RESET (Data_file);

      WHILE NOT EOF(Data_file) DO
      BEGIN
      READ (Data_file, T );

         IF NOT EOF(Data_file) THEN
         BEGIN
         READ (Data_file, Skip);
         READ (Data_file, A );
         READ (Data_file, Skip);
         READLN (Data_file, Lolimit [ T, A ]);
         END; { end if not end of file  }

      END; { end while not end of file  }

   CLOSE (Data_file);
```

```
END; { Lolimit procedure }

{*****************************************************************************
*****************************************************************************}

{.pa}


PROCEDURE DirList;
{
          This is a simple program to list out the directory of the
          current (logged) drive in accordance with filetype chosen.
            MODIFIED BY RBA  }

type
   Char12arr            = array [ 1..12 ] of Char;
   String20             = string[ 20 ];
   RegRec =
      record
         AX, BX, CX, DX, BP, SI, DI, DS, ES, Flags : Integer;
      end;

var
   Regs                 : RegRec;
   DTA                  : array [ 1..43 ] of Byte;
   Mask                 : Char12arr;
   NamR                 : String20;
   X,Y,Error, I             : Integer;

begin { main body of program DirList }
   FillChar(DTA,SizeOf(DTA),0);        { Initialize the DTA buffer }
   FillChar(Mask,SizeOf(Mask),0);      { Initialize the mask }
   FillChar(NamR,SizeOf(NamR),0);      { Initialize the file name }
   Regs.AX := $1A00;          { Function used to set the DTA }
   Regs.DS := Seg(DTA);       { store the parameter segment in DS }
   Regs.DX := Ofs(DTA);       {   "     "       "     offset in DX }
   MSDos(Regs);               { Set DTA location }
   Error := 0;

      IF Choice = '1' THEN Mask := '????????.nod';
      IF Choice = '2' THEN Mask := '????????.ard';
      IF Choice = '3' THEN Mask := '????????.led';
      IF Choice = '4' THEN Mask := '????????.hid';
      IF Choice = '5' THEN Mask := '????????.lod';
            { Use global search }
   Regs.AX := $4E00;           { Get first directory entry }
   Regs.DS := Seg(Mask);       { Point to the file Mask }
   Regs.DX := Ofs(Mask);
   Regs.CX := 22;              { Store the option }
   MSDos(Regs);                { Execute MSDos call }
   Error := Regs.AX and $FF;   { Get Error return }
   I := 1;                     { initialize 'I' to the first element }

   if (Error = 0) then

      repeat
      NamR[I] := Chr(Mem[Seg(DTA):Ofs(DTA)+29+I]);
      I := I + 1;
      until not (NamR[I-1] in [' '..'.']) or (I>20);

   NamR[0] := Chr(I-1);          { set string length because assigning }
                                 { by element does not set length }

      IF (Error = 0) THEN
      BEGIN
      X := LENGTH (NamR);
      Y := X-4;
      DELETE (NamR,Y,4);
      WRITELN(NamR);
      END;

      while (Error = 0) do begin
```

```
        Error := 0;
        Regs.AX := $4F00;           { Function used to get the next }
                                                { directory entry }
        Regs.CX := 22;              { Set the file option }
        MSDos( Regs );              { Call MSDos }
        Error := Regs.AX and $FF;   { get the Error return }
        I := 1;

           repeat
           NamR[I] := Chr(Mem[Seg(DTA):Ofs(DTA)+29+I]);
           I := I + 1;
           until not (NamR[I-1] in [' '..'*'] ) or (I > 20);

        NamR[0] := Chr(I-1);

           IF (Error = 0) THEN
           BEGIN
           X := LENGTH (NamR);
           Y := X-4;
           DELETE (NamR,Y,4);
           WRITELN(NamR);
           END;  { error if}

        END; { while do loop }
end; { of procedure DirList  }
```

APPENDIX G
SWOPATH CALCULATIONS INCLUDE FILE

```
{*************************************************************************
*************************************************************************}

{ This file contains the following procedures

      Ask_for_years
      Calculations

}

PROCEDURE Ask_for_years;

VAR

   Years_wanted,
   Qtrs_wanted: INTEGER;

BEGIN

   REPEAT { until NRYears answer is an integer }

      REPEAT { until NRQuarters answer is an integer }
      Blankline (23, 1);
      WRITE ('       Choose 0 years & 0 quarters to quit.');
      DELAY (2000);
      Blankline (23, 1);

         REPEAT  { until correct answer }
         Blankline (24, 1);
         WRITE ('  Do you desire to reinitialize','',
                                          '(set to zero) yrs & qtrs? (Y/N) ');
         READ (Kbd, Answer);
         Correct_answer (Answer, OK_answer);
         UNTIL OK_answer = true;

      IF Answer in ['Y','y'] THEN
      BEGIN
      NRQuarters := 0;
      YRCount := 0;
      Quarter := 0;
      TempCount := 0;
      END; {reset yrs and qtrs to zero }

      Blankline (24, 1);
      WRITE ('How many years: <CR>and quarters: <CR>do you want to run the model?'
);
      GotoRC (24, 16);

      {$I-} READ (Years_wanted) {$I+};
      OK_answer := (IORESULT = 0); {TURBO PASCAL function to check input type }

         IF NOT OK_answer THEN Invalid_answer;

      UNTIL OK_answer = true;

   GotoRC (24, 34);
   {$I-} READ (Qtrs_wanted) {$I+};
   OK_answer := (IORESULT = 0); {TURBO PASCAL function to check input type }

      IF (Qtrs_wanted < 0) OR (Qtrs_wanted > 3) THEN OK_answer := false;

         IF NOT OK_answer THEN Invalid_answer;

   UNTIL OK_answer = true;

   NRQuarters :=  Qtrs_wanted + (Years_wanted * 4);

      IF (Qtrs_wanted + (Years_wanted * 4) = 0) THEN
      BEGIN
      Color ( white, red);
```

```
      Blankline (24, 1);
      WRITE ('You have chosen 0 yrs & 0 qtrs.  Returning to selection menu.');
      DELAY (2000);
      Color ( white, blue);
      Blankline (24, 1);
      EXIT;  ( Exit from ask for years procedure )
      END;  ( if NRquarters = 0 )

   Calculations;
END; (Ask_for_years)


{.pa}
{*****************************************************************************
*****************************************************************************}

PROCEDURE Calculations;     ( Modified 20 October 1985   -- RBA )
                                        ( Modified 05 November 1897  -- TFS )
VAR

   Temp,
   Temporary: REAL;
   TT,
   LL,
   L: INTEGER;
   AA: CHAR;
   Data_file: TEXT;
   Transfers: Two_Dim_Real;

BEGIN

   Toomany:=false;
   Blankline (24, 1);
   WRITE ('                        Beginning calculations.                        ');
   QtrCount:= 0;                              ( initialize quarter counter )

      FOR TT := 12 DOWNTO 1 DO                 ( initialize stocks )
      BEGIN
         FOR AA := 'A' TO 'H' DO
         BEGIN
            FOR LL := 1 TO 16 DO
            BEGIN
            Temp_billet_node [TT, AA, LL] := Billet_node [TT, AA, LL];
            END; ( LL loop )

         END; ( AA loop )

      END; ( TT loop )

      REPEAT
      QtrCount := QtrCount + 1;      ( increment quarter counter )

         FOR T:= 12 DOWNTO 1 DO
         BEGIN                            (T Loop)

            FOR A:= 'A' TO 'H' DO
            BEGIN                          (A loop - mathematical calculations)

            L:= 1;                         (length of billet nodes in quarters)

          {  Beginning of modifications [illegible] 85  )

              REPEAT                       ( move officers down one quarter )
              Temp_Billet_node [ T, A, L ] := Temp_Billet_node [ T, A, L+1];
              Temp_billet_node [ 1, [illegible] ] := 0.0;
              L := L + 1;
              UNTIL L = 16 ;               ( [illegible] 85 87 -- TFS )

                                                  ( compute transfers )

              IF T <> 1  THEN
              BEGIN
              Transfers [ T-1, A ] :=
                    (Temp_Billet_Node [ T-1, A , 1 ] * Transfer_Path [T-1,'A',A]) +
                    (Temp_Billet_Node [ T-1, B , 1 ] * Transfer_Path [T-1,'B',A]) +
                    (Temp_Billet_Node [ T-1, C , 1 ] * Transfer_Path [T-1,'C',A]) +
```

```
            (Temp_Billet_Node [ T-1, 'D' , 1 ] * Transfer_Path [T-1,'D',A]) +
            (Temp_Billet_Node [ T-1, 'E' , 1 ] * Transfer_Path [T-1,'E',A]) +
            (Temp_Billet_Node [ T-1, 'F' , 1 ] * Transfer_Path [T-1,'F',A]) +
            (Temp_Billet_Node [ T-1, 'G' , 1 ] * Transfer_Path [T-1,'G',A]);
                                              { compute temporary stocks }
      Temporary :=   Temp_Billet_Node [ T, A, Billet_Length [ T, A ]];
                                              { sum transfers and temporary stocks }
      Temp_Billet_Node [ T, A, Billet_Length [ T, A ]]:=
             Transfers [T-1, A] + Temporary;
                                              { compute total stocks }
      Final_totals := false;
      Billet_totals (T,A);
      END

      ELSE                          { now T equals 1 }
      BEGIN                         { 11/05/87 -- TFS }
         Temporary := Temp_billet_node [ T, A, Billet_length [ T, A ]];

    IF A <> 'E'  THEN
        BEGIN
        Temp_billet_node [ T, A, Billet_length [T, A ]]:=
                Temporary;
        END

        ELSE
        BEGIN
        Temp_billet_node [ T, A, Billet_length [ T, A ]] :=
                Temporary + Accessions;
        END; { IF A = E}

      Final_totals := false;
      Billet_totals (T,A);
      END; {if t = 0 }

      { End of modifications 10/20/85 }
                                          { test for Hi limit }
         IF Temp_billet_total [ T, A ] > Hilimit [ T, A ] THEN
         BEGIN
         Violation := true;
         High_warning;
            IF Stop_calc_T THEN EXIT;
         END;                   {if high warning}
                                          { test for Low limit }
         IF Temp_billet_total [ T, A ] < Lolimit [ T, A ] THEN
         BEGIN
         Violation := true;
         Low_warning;
            IF Stop_calc_T THEN EXIT;
         END; { if low warning }
      END;   { A Loop }
   END;                  {T Loop and mathematical calculations}
UNTIL (QtrCount = NRQuarters) OR Toomany;
   IF NOT Violation THEN
   BEGIN
   TempCount := TempCount + QtrCount;
   YrCount := TRUNC (TempCount/4);
      IF ((YrCount * 4) > Tempcount) THEN YrCount := YrCount - 1;
   Quarter := TempCount - (YrCount * 4);

      FOR TT := 12 DOWNTO 1 DO
      BEGIN
         FOR AA := 'A' TO 'H' DO
```

```
                BEGIN
                   FOR LL := 1 TO 16 DO
                   BEGIN
                   Billet_node [TT, AA, LL] := Temp_Billet_node [TT, AA, LL];
                   END; { LL loop }
                END; { AA loop }
             END; { TT loop }
          Final_totals := true;
          All_billet_totals;
          END; { violations if }
END;  (calculations)
```

APPENDIX H
SWOPATH SCREENS INCLUDE FILE

```
{*************************************************************************
*************************************************************************}
( This file contains the following procedures
      Dchoices          ( modified 11/05/87 -- TFS )
      Dchanges
      From_pathscrn
      To_pathscrn
)

PROCEDURE Dchoices;
(  This procedure provides the display screen and answer evaluation
     for the choices indicated )
VAR
   OK_range,
   OK_tour,
   OK_activity: Boolean;
BEGIN
   OK_tour := false;
   OK_activity := false;
   GotoRC (1, 1);
   WRITELN ('   ',Chg_var);                          ( 11/05/87 -- TFS )
   WRITELN;WRITELN;
   WRITELN ('                  TOUR                  ACTIVITY');
   WRITELN;
   WRITELN ('                  1.  FIRST             A.  PROFESSIONAL TRNG ');
   WRITELN ('                  2.  SECOND            B.  PROFESSIONAL EDUC ');
   WRITELN ('                  3.  THIRD             C.  JOINT EDUC        ');
   WRITELN ('                  4.  FOURTH            D.  JOINT TOUR        ');
   WRITELN ('                  5.  FIFTH             E.  FLEET UNIT        ');
   WRITELN ('                  6.  SIXTH             F.  AFLOAT STAFF      ');
   WRITELN ('                  7.  SEVENTH           G.  SHORE             ');
   WRITELN ('                  8.  EIGHTH            H.  SEPARATION        ');
   WRITELN ('                  9.  NINTH');
   WRITELN ('                 10.  TENTH');
   WRITELN ('                 11.  ELEVENTH');
   WRITELN ('                 12.  TWELFTH');
   GotoRC (22,5);
   WRITELN ('   TOUR:    (type number<CR>)  ACTIVITY:    (type letter)');
      REPEAT ( Until Ok_tour true )
         REPEAT ( Until OK_activity true )
            IF NOT Ok_tour OR NOT Ok_range THEN
            BEGIN
            GotoRC (22, 14);
            ($I-) READ ( T ) ($I+) ; (read TOUR number but first cancel I/O )
                                       ( checking to prevent error if non integer )
                                       ( key is struck accidentally. Then turn back on )
            OK_tour := (IORESULT = 0);  ( TURBO PASCAL I/O error check.  If input )
                                          ( was in fact correct i.e. an integer then )
                                          ( the TB function IORESULT will return a 0 )

            IF (T >= 1) AND (T <= 12) THEN Ok_range := true;
            IF (T < 1) OR (T > 12) THEN Ok_range := false;
            IF NOT OK_tour OR NOT Ok_range THEN Wrong_answer;

            END; ( Ok_tour correct if )
         UNTIL (Ok_tour AND Ok_range) = true;
```

```
         IF NOT OK_activity THEN
         BEGIN
         GotoRC (22, 46);
         READ (kbd,  A ); (read ASSIGNMENT letter)
         A := UPCASE ( A );
         First := 'A'; Last := 'H'; OK_choice := true;
         Correct_choice ( A, First, Last, OK_choice);
         OK_activity := Ok_choice;
         END;   ( if not oK activity )

      UNTIL (Ok_tour and OK_activity ) = true;

   Clearscreen;

END; (choices)

(*****************************************************************************
*****************************************************************************)

(.pa)

PROCEDURE Dchanges;

( This procedure provides the  choice menu display and
   also evaluates the responses )

BEGIN

   IF NOT (POS ('.',Nodedata) = 0) THEN Strip (Nodedata);
   IF NOT (POS ('.',Arcdata) = 0) THEN Strip (Arcdata);
   IF NOT (POS ('.',Lengdata) = 0) THEN Strip (Lengdata);
   IF NOT (POS ('.',Hilidata) = 0) THEN Strip (Hilidata);
   IF NOT (POS ('.',Lolidata) = 0) THEN Strip (Lolidata);

   Clearscreen;
   GotoRC (3, 5);
   WRITELN (Chg_var);
   WRITELN;
   WRITELN ('     Data:                                          Data files:');
   WRITELN;
   GotoRC (8, 1);
   WRITELN ('     0. ',Choice_zero);
   WRITELN ('     1. Number of officers at each assignment: ', Nodedata );
   WRITELN ('     2. Transfer path percentages:             ', Arcdata  );
   WRITELN ('     3. Assignment tour lengths:               ', Lengdata);
   WRITELN ('     4. High limits:                           ', Hilidata );
   WRITELN ('     5. Low limits:                            ', Lolidata );
   WRITELN;WRITELN;

      REPEAT (until choice correct )
      GotoRC (16,1);
      WRITE ('   Type your selection [0,1,2,3,4,5]: ');
      READ (Kbd, Choice); (read input into var selection)
      First := '0';  Last := '5'; OK_choice := true;  (inputs for correct_choice
)
      Correct_Choice (Choice, First, Last, OK_choice);      (        procedure.
         )
      UNTIL OK_choice = true;

END; (Dchanges)
(*****************************************************************************
*****************************************************************************)

(.pa)

PROCEDURE From_pathscrn;

( This procedure simply draws the illustration on the screen )

BEGIN

   Clearscreen;
   WRITELN('                                    /---            ');
   WRITELN('                                   /                ');
   WRITELN('                                  /                 ');
   WRITELN('                                 /------            ');
   WRITELN('                                /                   ');
   WRITELN('                               /                    ');
```

```
   WRITELN('                          /---------          ');
   WRITELN('                         /                    ');
   WRITELN('                        /                     ');
   WRITELN('                       /------------          ');
   WRITELN('                      <                       ');
   WRITELN('                       \                      ');
   WRITELN('                        \-----------          ');
   WRITELN('                         \                    ');
   WRITELN('                          \                   ');
   WRITELN('                           \--------          ');
   WRITELN('                            \                 ');
   WRITELN('                             \                ');
   WRITELN('                              \-----          ');
   WRITELN('                               \              ');
   WRITELN('                                \             ');
   WRITELN('                                 \--          ');
END; { From_pathscrn }

(*****************************************************************************
*****************************************************************************)

(.pa)

PROCEDURE To_pathscrn;

{ This procedure simply draws the illustration on the screen }

BEGIN

   Clearscreen;
   WRITELN ('                          ---------\          ');
   WRITELN ('                                    \         ');
   WRITELN ('                                     \        ');
   WRITELN ('                          ------------\       ');
   WRITELN ('                                       \      ');
   WRITELN ('                                        \     ');
   WRITELN ('                          ---------------\    ');
   WRITELN ('                                          \   ');
   WRITELN ('                                           \  ');
   WRITELN ('                          -------------------\');
   WRITELN ('                                              >');
   WRITELN ('                                             / ');
   WRITELN ('                          -----------------/  ');
   WRITELN ('                                          /   ');
   WRITELN ('                                         /    ');
   WRITELN ('                          --------------/     ');
   WRITELN ('                                       /      ');
   WRITELN ('                                      /       ');
   WRITELN ('                          -----------/        ');
END;  { to pathscrn }
```

APPENDIX I
SWOPATH DISPLAYS INCLUDE FILE

```
      Disp_billets



PROCEDURE Disp_Assign;
  This procedure provides the activity v.s. all tours choices and displays
VAR
   X: INTEGER;
BEGIN
      REPEAT     until finished
      Finished:= false;
      Clearscreen;
      Center (03, 'Which activity are you interested in?');
      WRITELN;WRITELN;WRITELN;
      WRITELN ('                    A.  Professional Training');   11/05/87 - TFS
      WRITELN ('                    B.  Professional Education');
      WRITELN ('                    C.  Joint Educ ');
      WRITELN ('                    D.  Joint Tour          ');
      WRITELN ('                    E.  Fleet Unit');
      WRITELN ('                    F.  Afloat Staff');
      WRITELN ('                    G.  Shore ');
      WRITELN ('                    H.  Separation');
      WRITELN;
         REPEAT  until choice correct
         GotoRC (18,15);
         WRITE ('Type your choice: ');
         READ (Kbd, A);  read input into var selection
         A := UPCASE (A);
         First := 'A'; Last := 'H'; OK_choice := true;
         Correct_choice ( A, First, Last, OK_choice);
         UNTIL OK_choice = true ;
         Billet_total [ T, A ] := Billet_node [ T, A, 1 ] +
                  Billet_node [ T, A, 2 ] + Billet_node [ T, A, 3 ] +
                  Billet_node [ T, A, 4 ] + Billet_node [ T, A, 5 ] +
                  Billet_node [ T, A, 6 ] + Billet_node [ T, A, 7 ] +
                  Billet_node [ T, A, 8 ] + Billet_node [ T, A, 9 ] +
                  Billet_node [ T, A, 10 ] + Billet_node [ T, A, 11 ] +
                  Billet_node [ T, A, 12 ] + Billet_node [ T, A, 13 ] +
                  Billet_node [ T, A, 14 ] + Billet_node [ T, A, 15 ] +
                  Billet_node [ T, A, 16 ];
      Clearscreen;
      WRITELN;
      WRITELN ('    For    ',Yrcount,'  year(s) and    ,
                                  Quarter,'  quarter(s) calculations   ');
      WRITELN;
      WRITELN ('            For: ', Activity [ A ]);
      GotoRC (6, 1);
      WRITELN ('               TOURS.....');
      WRITELN;
      GotoRC (8, 10);
      WRITELN ('FIRST    SECOND       THIRD    FOURTH     FIFTH     SIXTH  ,
      GotoRC (14, 8);
      WRITELN ('SEVENTH    EIGHTH       NINTH     TENTH  ELEVENTH   TWELFTH  ,
      T:=1;
      X:= 5;
      GotoRC (10, X);
      Billet_total [ T, A ] := Billet_node [ T, A, 1 ] +
```

```
                Billet_node [ T, A, 2 ] + Billet_node [ T, A, 3 ] +
                Billet_node [ T, A, 4 ] + Billet_node [ T, A, 5 ] +
                Billet_node [ T, A, 6 ] + Billet_node [ T, A, 7 ] +
                Billet_node [ T, A, 8 ] + Billet_node [ T, A, 9 ] +
                Billet_node [ T, A, 10 ] + Billet_node [ T, A, 11 ] +
                Billet_node [ T, A, 12 ] + Billet_node [ T, A, 13 ] +
                Billet_node [ T, A, 14 ] + Billet_node [ T, A, 15 ] +
                Billet_node [ T, A, 16 ];
    WRITE (ROUND (Billet_total [ T, A ]):10);

       FOR T := 2 TO 6 DO
       BEGIN
       X := X + 10;
       GotoRC (10, X);
       Billet_total [ T, A ] := Billet_node [ T, A, 1 ] +
                Billet_node [ T, A, 2 ] + Billet_node [ T, A, 3 ] +
                Billet_node [ T, A, 4 ] + Billet_node [ T, A, 5 ] +
                Billet_node [ T, A, 6 ] + Billet_node [ T, A, 7 ] +
                Billet_node [ T, A, 8 ] + Billet_node [ T, A, 9 ] +
                Billet_node [ T, A, 10 ] + Billet_node [ T, A, 11 ] +
                Billet_node [ T, A, 12 ] + Billet_node [ T, A, 13 ] +
                Billet_node [ T, A, 14 ] + Billet_node [ T, A, 15 ] +
                Billet_node [ T, A, 16 ];
       WRITE (ROUND (Billet_total [ T, A ]):10);
       END;

    T :=7;
    X := 5;
    GotoRC (16, X);
    Billet_total [ T, A ] := Billet_node [ T, A, 1 ] +
                Billet_node [ T, A, 2 ] + Billet_node [ T, A, 3 ] +
                Billet_node [ T, A, 4 ] + Billet_node [ T, A, 5 ] +
                Billet_node [ T, A, 6 ] + Billet_node [ T, A, 7 ] +
                Billet_node [ T, A, 8 ] + Billet_node [ T, A, 9 ] +
                Billet_node [ T, A, 10 ] + Billet_node [ T, A, 11 ] +
                Billet_node [ T, A, 12 ] + Billet_node [ T, A, 13 ] +
                Billet_node [ T, A, 14 ] + Billet_node [ T, A, 15 ] +
                Billet_node [ T, A, 16 ];
    WRITE (ROUND (Billet_total [ T, A ]):10);

       FOR T  := 8 TO 12  DO
       BEGIN
       X  := X + 10;
       GotoRC (16, X);
       Billet_total [ T, A ]  := Billet_node [ T, A, 1 ] +
                Billet_node [ T, A, 2 ] + Billet_node [ T, A, 3 ] +
                Billet_node [ T, A, 4 ] + Billet_node [ T, A, 5 ] +
                Billet_node [ T, A, 6 ] + Billet_node [ T, A, 7 ] +
                Billet_node [ T, A, 8 ] + Billet_node [ T, A, 9 ] +
                Billet_node [ T, A, 10 ] + Billet_node [ T, A, 11 ] +
                Billet_node [ T, A, 12 ] + Billet_node [ T, A, 13 ] +
                Billet_node [ T, A, 14 ] + Billet_node [ T, A, 15 ] +
                Billet_node [ T, A, 16 ];
       WRITE (ROUND (Billet_total [ T, A ]):10);
       END;

       REPEAT   until answer correct
       Center (19, 'Do you desire to see another activity breakout? (Y/N) ');
       READ (Kbd, Answer);
       OK_answer := true;
       Correct_answer (Answer, OK_answer);
       UNTIL OK_answer = true;

       IF Answer in [ 'Y', 'y' ] THEN
       BEGIN
         clearscreen;
       Disp_Assign;
       END;

       IF Answer in [ 'N', 'n' ] THEN Finished := true;

    Until Finished = true;

clearscreen;
```

```
END; Disp_Assign
 ********************************************************************************
********************************************************************************
 .pa
PROCEDURE Disp_Tours;
  This procedure provides the tour v.s. all activities choices and displays
VAR
   Ok_range,
   Ok_tour,
   Ok_activity: Boolean;
BEGIN
   Ok_range := false;
   Ok_tour := false;
   Ok_activity := false;
      REPEAT   until finished
      Clearscreen;
      GotoRC (3, 5);
      CENTER (3,'Which Tour do you wish to see displayed?');
      WRITELN;WRITELN;
      WRITELN ('                    TOUR                  ');
      WRITELN;
      WRITELN ('                   1.  FIRST              ');
      WRITELN ('                   2.  SECOND             ');
      WRITELN ('                   3.  THIRD              ');
      WRITELN ('                   4.  FOURTH             ');
      WRITELN ('                   5.  FIFTH              ');
      WRITELN ('                   6.  SIXTH              ');
      WRITELN ('                   7.  SEVENTH            ');
      WRITELN ('                   8.  EIGHTH             ');
      WRITELN ('                   9.  NINTH');
      WRITELN ('                  10.  TENTH');
      WRITELN ('                  11.  ELEVENTH');
      WRITELN ('                  12.  TWELFTH');
      GotoRC (22, 5);
      WRITELN ('   TOUR:      (type number<CR>)');
         REPEAT    Until Ok_tour and Ok_range both true
         GotoRC (22, 14);
          $I-  READ ( T )  $I+  ;  read TOUR number but first cancel I/O
                                                checking to prevent error if non integer
                                                key is struck accidentally. Then turn back on
         Ok_tour := (IORESULT = 0);    TURBO PASCAL I/O error check.  If input
                                                was in fact correct i.e. an integer then
                                                the TB function IORESULT will return a 0

            IF  (T >= 1) AND (T <= 12) THEN Ok_range := true;
            IF  (T < 1) OR (T > 12) THEN Ok_range := false;
            IF NOT Ok_tour OR NOT Ok_range THEN Wrong_answer;

         UNTIL (Ok_tour AND Ok_range) = true;
    FOR A := 'A' TO 'H' DO
    BEGIN
    Billet_total [ T, A ] := Billet_node [ T, A, 1 ] +
                 Billet_node [ T, A, 2 ] + Billet_node [ T, A, 3 ] +
                 Billet_node [ T, A, 4 ] + Billet_node [ T, A, 5 ] +
                 Billet_node [ T, A, 6 ] + Billet_node [ T, A, 7 ] +
                 Billet_node [ T, A, 8 ] + Billet_node [ T, A, 9 ] +
                 Billet_node [ T, A, 10 ] + Billet_node [ T, A, 11 ] +
                 Billet_node [ T, A, 12 ] + Billet_node [ T, A, 13 ] +
                 Billet_node [ T, A, 14 ] + Billet_node [ T, A, 15 ] +
                 Billet_node [ T, A, 16 ];
     END;  for loop
                                        11/05/87 -- TFS
     Clearscreen;
     WRITELN ('  For    ',Yrcount,'  year(s) and  ',Quarter,'  quarter(s) calcula
tions. ');
```

```
      WRITELN ('              For: ', Tour [ T ]);
      WRITELN ('                   ');
      WRITELN ('  Activity:                    Number of officers');
      WRITELN ('                                                  ');
      WRITELN ('  Professional Training  : ', ROUND (Billet_total [ T, 'A' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Professional Education : ', ROUND (Billet_total [ T, 'B' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Joint Educ             : ', ROUND (Billet_total [ T, 'C' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Joint Tour             : ', ROUND (Billet_total [ T, 'D' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Fleet Unit             : ', ROUND (Billet_total [ T, 'E' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Afloat Staff           : ', ROUND (Billet_total [ T, 'F' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Shore                  : ', ROUND (Billet_total [ T, 'G' ]):10);
      WRITELN ('                                                  ');
      WRITELN ('  Separation             : ', ROUND (Billet_total [ T, 'H' ]):10);
      WRITELN ('                                                  ');
      Tour_sum [ T ] := Billet_total [ T, 'A'] + Billet_total [ T, 'B'] +
                        Billet_total [ T, 'C'] + Billet_total [ T, 'D'] +
                        Billet_total [ T, 'E'] + Billet_total [ T, 'F'] +
                        Billet_total [ T, 'G'] + Billet_total [ T, 'H'];
      WRITELN ('  Total officers         : ', ROUND (Tour_sum [ T ]):10);

         REPEAT   until answer correct
         Blankline (24,1);
         WRITE ('Do you desire to see another tour breakout? (Y/N)  ');
         READ (Kbd, Answer);
         OK_answer := true;
         Correct_answer (Answer, OK_answer);
         UNTIL OK_answer = true;

         IF Answer in [ 'Y','y'] THEN
         BEGIN
         Disp_tours;
         END;

         IF Answer in [ 'N','n' ] THEN Finished := true;

      UNTIL Finished = true;

   Clearscreen;

END;  Disp_Tours

 ********************************************************************************
********************************************************************************

 .pa

PROCEDURE Disp_paths_from;

   This procedure displays the transfer path percentages FROM

VAR

   OK_selection,
   OK_tour,
   OK_activity: BOOLEAN;
   ZZ : CHAR;
   R,
   RR : INTEGER;

BEGIN

   OK_tour := false;
   OK_activity := false;
   Finished := false;

      REPEAT  until finished

         REPEAT   until tour/activity selection ok
         OK_selection := true;
         Clearscreen;
         Chg_var := 'Which assignment do you wish to see the transfer paths from?';
         Dchoices;
```

```
            Clearscreen;

               IF (T = 12) THEN
               BEGIN
               OK_selection := false;
               Color ( white, red);
               Blankline (24,1);
               WRITE (' There are no transfer paths from Twelfth Tour assignments.');
               DELAY (2000);
               Color ( white, blue);
               Blankline (24,1);
               END;   if tour 12 is chosen

               IF A in ['H'] THEN
               BEGIN
               OK_selection := false;
               Color ( white, red);
               Blankline (24,1);
               WRITE (' There are no transfer paths from Separation assignments.');
               DELAY (2000);
               Color ( white, blue);
               Blankline (24,1);
               END;   if tour 12 is chosen

            UNTIL OK_selection = true;

         From_pathscrn;
         GotoRC (6, 5);
         WRITELN ('  Display for ');
         GotoRC (7, 5);
         WRITELN (' ',YrCount,'  years and');
         WRITE ('     ',Quarter,' quarters');
         GotoRC (10, 5);
         WRITE ('   FROM');
         GotoRC(11, 2);
         WRITE (Tour  [ T ],Activity [ A ]);
         GotoRC (13, 6);
         WRITE (ROUND (Billet_node[T,A,1]),' officers');
         WRITE (' will be transferred.');
         R := 1;
         RR := 2;
         FOR ZZ := 'A' TO 'H' DO
         BEGIN
         GotoRC ( R, 40);
         WRITE ('TO ', Tour [ T+1 ], Activity [ ZZ ]);
         GotoRC (RR, 42);
         WRITE ('',(Transfer_path[T,A,ZZ]*100):4:0,'%   or ',
                  ROUND ((Billet_node[T,A,1])*(Transfer_path[T,A,ZZ])),' officers');
         R := R + 3;
         RR := RR + 3;
         END;

         REPEAT  until answer correct
         Blankline (24, 1);
         WRITE ('Do you desire to see another transfer path breakout? (Y/N) ');
         READ (Kbd, Answer);
         Correct_answer (Answer, OK_answer);
         UNTIL OK_answer = true;

      OK_tour := false;       to prevent p[illegible] from
      Ok_activity := false;  repeating end[illegible]...

         IF Answer in ['N','n'] THEN Finished := true;

      UNTIL Finished = true;

   END;  Disp_paths_from

    ********************************************************************************
   ********************************************************************************

    .pa

   PROCEDURE Disp_paths_to;

     This procedure displays the transfer path [illegible] ontages TO
```

```
VAR
   Ok_selection,
   Ok_tour,
   Ok_activity: BOOLEAN;
   ZZ : CHAR;
   R,
   RR : INTEGER;
   Total: REAL;
BEGIN
   Ok_tour := false;
   Ok_activity := false;
   Finished := false;
      REPEAT  until finished
         REPEAT   until ok selection
         Ok_selection := true;
         Clearscreen;
         Chg_var := 'Which assignment do you wish to see the transfer paths to?';
         Dchoices;
         Clearscreen;
            IF (T = 1) THEN
            BEGIN
            Ok_selection := false;
            Color ( white, red);
            Blankline (24,1);
            WRITE (' There are no transfer paths to First Tour assignments.');
            DELAY (2000);
            Color ( white, blue);
            Blankline (24, 1);
            END;   if tour 12 is chosen
         UNTIL Ok_selection = true;
      To_pathscrn;
      GotoRC (6, 55);
      WRITELN (' Display for ');
      GotoRC (7, 55);
      WRITELN(YrCount,' years and');
      GotoRC (8, 55);
      WRITE (Quarter,' quarters');
      GotoRC (10, 55);
      WRITELN (' TO');
      GotoRC (11, 55);
      WRITELN (Tour [ T ],Activity [ A ]);
      GotoRC (18, 45);
      WRITE ('NOTE: Percentages reflect the % of');
      GotoRC (19, 45);
      WRITE ('officers transferred OUT OF the');
      GotoRC (20, 45);
      WRITE ('indicated "FROM" assignment.');
      R := 1;
      RR := 2;
      Total := 0;
         FOR ZZ := 'A' TO 'G' DO
         BEGIN
         GotoRC ( R, 1);
         WRITELN ('FROM ', Tour [ T-1 ], Activity [ ZZ ]);
         GotoRC (RR, 1);
         WRITE ('',(Transfer_path[T-1,ZZ,A]*100) 4:0,'%   or ',
                  ROUND ((Billet_node[T-1,ZZ,1])*(Transfer_path[T-1,ZZ,A])),' officers
');
         Total := Total + ((Billet_node[T-1,ZZ,1])*(Transfer_path[T-1,ZZ,A]));
         R  := R + 3;
         RR  := RR + 3;
         END;
      GotoRC (13, 53);
      WRITE (ROUND (Total), ' officers');
```

```
         REPEAT  until answer correct
         Blankline (24,1);
         WRITE ('Do you desire to see another transfer path breakout? (Y/N) ');
         READ (Kbd, Answer);
         Correct_answer (Answer, Ok_answer);
         UNTIL Ok_answer = true;
      Ok_tour := false;       to prevent procedure from
      Ok_activity := false;  repeating endlessly
         IF Answer in ['N','n'] THEN Finished:= True;
      UNTIL Finished = true;
END;   Disp_paths_to
 ********************************************************************************
********************************************************************************
 .pa
PROCEDURE Disp_billets;
  This procedure provides the billet by tour length choices and displays
VAR
   Officer_totals: REAL;
   X : INTEGER;
   Finished,
   Ok_tour,
   Ok_activity: BOOLEAN;
BEGIN
   Ok_tour := false;
   Ok_activity := false;
      REPEAT   until finished
      Clearscreen;
      Chg_var := 'Which assignment do you wish to see?';
      Dchoices;
      Clearscreen;
      WRITELN;WRITELN;
      WRITELN ('    After   ', Yrcount,' year(s)   ',
                                Quarter,' quarter(s)');
      WRITELN ('           ',Tour [T],' ',Activity [A]);
      WRITELN ('          Tour Length of ',
                                 Billet_length [T,A],' quarters.');
      WRITELN ('    Officers assigned:');
      WRITELN;
      Officer_totals := 0;
         FOR X := 1 TO 16 DO
         BEGIN
         WRITELN ('     ',ROUND(Billet_node [ T, A, X ]),'      ', TLength [ X ]);
         Officer_totals := Officer_totals + Billet_node [ T, A, X ];
         END;   do loop
      WRITELN;
      WRITELN (' The total number of officers assigned is ',
                  ROUND (Officer_totals));
         REPEAT   until answer is correct
         Blankline (24,1);
         WRITE ('Do you desire to see another assignment?  (Y/N)  ');
         READ (Kbd, Answer);
         Correct_answer (Answer, Ok_answer);
         UNTIL Ok_answer = true;
         IF Answer in ['N','n']  THEN Finished:=true;
      UNTIL Finished = true;
   Clearscreen;
END;   Disp billet nodes
```

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